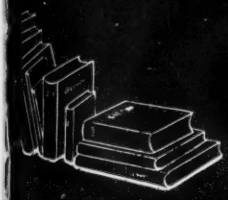
ABSTRACTS OF NORTH AMERICAN GEOLOGY



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ABSTRACTS OF NORTH AMERICAN GEOLOGY

INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals, but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with limited circulations (such as dissertations, open-file reports, or memorandums) or of other papers presented orally at meetings.

The Abstracts will be an additional reference tool but will not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology will be published each year. The Bibliography will include citations and subject index for a calendar year.

Abstracts of North American Geology and the Bibliography are being prepared by use of computer techniques. Each abstract along with its indexing is placed on magnetic tape and entered into a permanent data bank. The material prepared each month will be published in the form of the present issue. The abstracts are arranged alphabetically according to senior author. A subject index follows the abstracts and is designed for rapid reference to any subject desired. Bibliographies can subsequently be retrieved according to the terms used in the index.

The abstracts in this issue were prepared by F. W. Cater, Joan R. Clark, Georgianna D. Conant, Margaret Cooper, Richard S. Fiske, S. E. Frezon, E. E. Glick, John W. Hosterman, Virginia M. Jussen, B. H. Kent, B. F. Leonard, Marie L. Lindberg, Mildred C. Mead, A. T. Miesch, D. R. Mullineaux, Virginia S. Neuschel, Louis L. Ray, A. E. Roberts, Eugene H. Roseboom, S. P. Schweinfurth, Dorothy B. Vitaliano, Walter S. White, R. E. Wilcox.

0344 **Algermissen, S. T.; Harding, Samuel T.** Preliminary seismological report, *in* The Puget Sound, Washington earthquake of April 29, 1965: Washington, D. C., U.S. Coast and Geod. Survey, p. 1–26, 1965.

The Puget Sound earthquake of April 29, 1965, epicentered at lat 47° N., long 122.3° W., had a focal depth of 59 km, intensity of VII (Modified Mercalli), magnitude of 6.5, and was felt over an area of 130,000 sq mi. The area, part of a moderately active zone of seismicity extending from the vicinity of Portland, Oreg., to Vancouver Island, has shown a greatly increased level of seismic activity in the last 25 years. This shock was the second strongest since 1833, and was typical of others recorded for the area in that aftershock activity was practically nonexistent. All fault-plane solutions indicate a gravity type fault with northwest strike.—V.S.N.

0326 **Allan, Urban S.** North Bancroft and West Bivens fields, Beauregard Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 24–24c, illus., 1964.

Ames, H. T. *See* Kremp, G. O. W. 0056

Anders, Edward. *See* Studier, M. H. 0163

0134 **Anderson, Gerald J.; Randolph, E. Richard.** The development of the Empire Mine on the Marquette Iron Range, *in* Mining Symposium, 26th Ann., Duluth, 1965 (AIME, Minnesota Sec., 38th Ann. Mtg.): Minneapolis, Univ. Minnesota Center Continuation Study, p. 1–8, illus., 1965.

This mine near Negaunee, Mich., is a newly developed low-grade magnetite property, initially field sampled in 1948. Four subdivisions of the major ore horizon are apparent, each of which responds differently in the mill. Other features such as surface oxidation and oxidation along faults require close geologic control of crude ore feed. The orebody, in contrast with the specular hematites in Michigan's other deposits, is a fine-grained magnetite-bearing section in the lower Negaunee iron-formation in the extreme southeast corner of the Marquette Range syncline. The old Empire mine between 1887 and 1927 produced 768,474 tons of siliceous hematite from a small pit on the edge of the present mine.—G.D.C.

0305 **Anderson, Robert A.** Big Lake field, Cameron Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 2–2d, illus., 1964.

0284 **Anderson, Sidney B.; Carlson, Clarence.** Madison subcrop-Spearfish isopach map, Bottineau area: North Dakota Geol. Survey Rept. Inv. 30, scale about 1 in to 2 1/2 mi, text, revised 1965; originally published 1958.

This revision reflects the changes due to subsequent drilling since 1958 and changes in the terminology applied to the Madison Group. All wells completed as of May 1, 1965, were plotted, even though some of them did not provide data for either the isopach, the subcrop, or both parts of the map. Mechanical logs were available for most wells. Subdivisions of the Madison are Poplar, Ratcliffe, Frobisher-Alida, and Tilston; these intervals are further subdivided into subintervals on the map, but informal names have not been designated for most of them. The map indicates

a synclinal area present in the northeastern section, the western edge of which is closely coincident with the present edge of the Devonian salt.—M.C.M.

0246 **Anderson, Wayne I.** Upper Devonian and Lower Mississippian conodont faunas, north-central Iowa: Iowa Acad. Sci. Proc. 1964, v. 71, p. 320–334, illus., tables, 1965.

In an attempt to recognize the Upper Devonian and Lower Mississippian conodont zones and to define the Devonian–Mississippian boundary in this area, a study was made of conodont faunas. However, except for the Lower *Palmatolepsis gigas* Zone in the Lime Creek Formation (Devonian), no distinct conodont zones were recognized. The Devonian–Mississippian boundary in the area occurs between the Aplington Formation (Devonian) and either the Hampton Formation or the "English River Siltstone," not present everywhere. In one case, where "Maple Mill Shale" (Devonian) overlies the Aplington, it forms the boundary with the siltstone.—M.C.

0309 **Andrew, Philip J.** Deep Lake Field, Cameron Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 7–7d, illus., 1964.

0002 **Andrews, Peter B.** Serpulid reefs, Baffin Bay, southeast Texas, *in* Depositional environments, south-central Texas coast—Gulf Coast Assoc. Geol. Socs., Ann. Mtg., 1964, Field Trip Guidebook: Austin, Tex., Gulf Coast Assoc. Geol. Socs., p. 101–120, illus., 1964.

Reefs composed of the calcareous tubes of dead serpulid worms are a characteristic feature of the highly saline Baffin Bay and northern Laguna Madre. The reefs are in two distinct forms—a small isolated *patch reef* and a large, irregularly shaped *reef field*. Patch reefs are composed of alternating layers of random-tube and oriented-tube growth, the reef fields solely of the random growth form. These two forms, oriented and random, are interpreted to indicate optimum and adverse ecologic conditions, respectively. Optimum or normal salinities might have existed when the bays were connected to the Gulf of Mexico.—G.D.C.

0061 **Applegate, Shelton P.** Tooth terminology and variation in sharks with special reference to the sand shark, *Carcharias taurus* Rafinesque: Los Angeles County Mus. Contr. Sci., no. 86, 18 p., illus., tables, 1965.

Heterodonty in teeth is common in sharks. The use of three new terms is advocated: alternates, medials, and posteriors. Dental formulae can be used in classifying recent and fossil sharks. In *Carcharias taurus* Rafinesque, tooth length was found to be proportional to total length of the shark. Unassociated fossil teeth may be identified through the erection of artificial tooth sets if the teeth can reasonably be referred to a single species.—Author's abstract

0336 **Arps, Jan L.** An introduction to continuous electric logging while drilling: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 133–136, illus., 1964.

In order to provide electric logging information instantaneously and continuously while drilling, a new continuous logging-while-drilling system has been developed and successfully field tested. This tool, utilizing a unique mud pressure-pulse-telemetry system, provides a continuous resistivity log of the formations as they are penetrated by the drill bit. Along with the continuous resistivity log, a drilling rate curve and gas curve is also provided. The "focused monoelectrode" resistivity measuring method used in this system is described and its qualitative and quantitative advantages and disadvantages are discussed. Typical logs run while drilling are compared with conventional wireline logs, and the advantages of logging-while-drilling on exploratory wells are examined.—Author's abstract

0081 **Arro, Eric.** Morrowan sandstones in the subsurface of the Hough area, Texas County, Oklahoma: Shale Shaker, v. 16, no. 1, p. 2–16, illus., 1965.

From a study of available well samples, sandstone cores, and electrical logs, Arro draws the following conclusions regarding conditions of deposition of the upper

Morrow Formation on the northwestern shelf of the Anadarko basin: The numerous superimposed sandstones may be zoned by means of shale horizons; a non-marine channel trends northwest to southeast; the uppermost sandstone, trending 90° to the channel, is wave-sorted with bar and sheet structures; the source area is granitic, probably to the west; better sorting and less fine material favor the uppermost sandstone as the major petroleum reservoir rock; and bars and sheets are alined close to the source channel but become irregular away from it.—G.D.C.

0365 **Azároff, Leonid V.** Imperfections in crystals and their effect on X-ray diffraction by crystals, *in* Advanced methods of crystallography: London and New York, Academic Press, p. 251–269, illus., 1964.

An introduction is given here to the principal defect types that occur in crystals and some of the X-ray methods developed for their observation. In a slightly modified classification scheme they are grouped as transient, point, line, plane, and volume defects. For further details regarding their nature, the reader is referred to specified books in the accompanying literature list.—G.D.C.

0270 **Badgley, Peter C.; Fischer, William; Lyon, Ronald J. P.** Geologic exploration from orbital altitudes: Geotimes, v. 10, no. 2, p. 11–14, illus., 1965.

In planning geological exploration from orbiting spacecraft, the National Aeronautics and Space Administration is evaluating new and refined exploration tools, often called remote sensors, including devices that are sensitive to force fields, such as gravity gradient systems, and devices that record the reflection or emission of electromagnetic energy. Both active and passive sensors are being considered. They will be applied first to exploration of the Earth from orbital altitudes. Prototype instruments are now being used on aircraft flights. In addition to testing equipment, these tests should add knowledge of the effects of terrain on sensor records, provide ways to calibrate data returned from orbiting sensors, and help to refine data handling and interpretation.—G.D.C.

0359 **Baird, A. K.; Copeland, D. A.; McIntyre, D. B.; Welday, E. E.** Note on "Biotite mica effect in X-ray spectrographic analysis of pressed rock powders," by A. Volborth (1964): Am. Mineralogist, v. 50, nos. 5–6, p. 792–795, tables, 1965.

A chemical analysis of a quartz monzonite previously determined by the authors ("q. monzonite 84") was quoted in a recent paper by Professor Volborth. More precise analyses have since been made of this rock, and this new data is presented. Because samples of this rock have been widely distributed to spectrographers for calibration purposes, the revised values should be noted.—R.S.F.

0069 **Ball Associates, Ltd.** (compiler) Surface and shallow oil-impregnated rocks and shallow oil fields in the United States: U.S. Bur. Mines Mon. 12, 375 p., illus., tables, 1965.

The results are presented of a survey of occurrences in the United States of tar sands and oil fields to subsurface depths of 500 feet. The Geological Survey and Interstate Oil Compact Commission made available for the study data in their files, and the Commission obtained additional information from various state officials. The Bureau of Mines was responsible for having it compiled, and published by the Interstate Oil Compact Commission. Five hundred and forty-six occurrences of tar sands and 383 shallow oil fields in 27 states are described. Reserve figures, available for only a few deposits, total 2.5 billion to 5.5 billion bbl of recoverable bitumen by known mining methods.—G.D.C.

Banks, D. C. *See* Nugent, R. C. 0144

0207 **Barnes, Robert H.** Mineral resources summary of the Campbells Station quadrangle, Tennessee: Nashville, Tennessee Div. Geology, 10 p., 1964.

This summary accompanies Tennessee Div. Geology Geol Map GM 65-NW by E. T. Luther (cited separately), and describes the phosphate and limestone resources of the Campbells Station quadrangle. The only area of previous mining and all other known deposits of phosphate are within the outcrop belt of the Bigby-Cannon

Limestone. The sources of limestone are in the Bigby–Cannon, Lebanon, and Carters Limestones. A potential resource is chert from the Fort Payne Formation.—M.C.M.

Barns, R. L. *See* Rubinstein, C. B. 0354

Barr, K. G. *See* Robson, G. R. 0297

0143 **Baxter, James W.** Limestone resources of Madison County, Illinois: Illinois Geol. Survey Circ. 390, 39 p., illus., tables, 1965.

Two thick limestone formations of Mississippian age outcrop in the Mississippi River bluffs near Alton, and lie beneath a thick silt overburden in a small upland area in northwestern Madison County. Chemical analyses and insoluble residue data indicate that the upper part of the St. Louis Limestone, near Alton, is the best all-purpose stone in the county. Its depth is progressively greater eastward from Alton. Less pure stone in the lower part of the St. Louis Limestone and the subjacent Salem Formation crops out at various places, especially along Rocky Ford and Piasa Creeks where drilling may reveal suitable sites for quarries.—G.D.C.

0161 **Baxter, James W.; Desborough, George A.** Areal geology of the Illinois fluorspar district—Pt. 2, Karbers Ridge and Rosiclare quadrangles: Illinois Geol. Survey Circ. 385, 40 p., illus., tables, geol. map, 1965.

The quadrangles, mostly in Hardin County, are on and near the axis of a large northwest-trending anticlinal dome in an area of many faults including the Rock Creek graben, which trends northeast across the dome. A subsidiary structure, Hicks dome, exposes limestone and chert of Devonian age north of the graben, the strata dipping into the Moorman–Eagle Valley syncline. Thirty-one sedimentary rock units of Devonian to Pennsylvanian and Pleistocene age are differentiated on the geologic map. The strata are intruded by small northwest-trending dikes of mica peridotite and lamprophyre. Breccias are associated with structures interpreted as diatremes. Fluorspar veins near Rosiclare have produced large tonnages. Limestone of Valmeryan age is quarried near Elizabethtown, and thin coal seams in the Abbott Formation have been mined intermittently.—G.D.C.

0267 **Beal, Laurence H.** Geology and mineral deposits of the Bunkerville mining district, Clark County, Nevada: Nevada Bur. Mines Bull. 63, 96 p., illus., tables, geol. maps, 1965.

In the Bunkerville (Copper King) mining district rock formations range in age from older Precambrian to Recent. Except for late Tertiary and Recent sedimentary rocks, most of the lithologic units are structurally complicated. The tectonic history of the Virgin Mountains is outlined, and the petrology and mineralization described. Limited tonnages of copper–nickel ores bearing cobalt and platinum and some tungsten, mica, and beryllium ores have been produced. In the pocket are geologic, mineral, and other maps.—G.D.C.

0177 **Beck, M. E., Jr.** Aeromagnetic map of northeastern Illinois and its geologic interpretation: U.S. Geol. Survey Geophys. Inv. Map GP-523, scale 1:250,000, separate text, 1965.

The aeromagnetic survey of northeastern Illinois was flown at 500 feet above ground; contour intervals are 25, 125, and 250 gammas. Much of the bedrock geology of this area is known only through well data, so knowledge of the basal sedimentary units and crystalline basement is scanty. The most complete stratigraphic section is along the southern margin, where sandstone, shale, and carbonaceous sedimentary rocks (Precambrian to Pennsylvanian) reach a thickness of at least 6,000 feet. The major structural elements probably developed during the Paleozoic as a result of prolonged minor warping and subsidence, with intermittent deposition. Despite absence of strong magnetic contrasts within the sedimentary column, some general correlations between aeromagnetic features and sedimentary structure are apparent. The text includes a basement contour map, and one showing magnetic units and Bouguer gravity.—M.C.M.

0008 **Beckett, P. H. T.** The cation-exchange equilibria of calcium and magnesium: Soil Sci., v. 100, no. 2, p. 118–123, illus., 1965.

In a natural soil, there are a number of exchange sites showing a specific affinity for Ca and a smaller number of sites showing an affinity for Mg. Once these sites are occupied, there is little difference between the affinity of the soil exchange surfaces for Mg or Ca.—J.W.H.

0001 **Behrens, E. William.** Oölite formation in Baffin Bay and Laguna Madre, Texas, *in* Depositional environments, south-central Texas coast—Gulf Coast Assoc. Geol. Socs., Ann. Mtg., 1964, Field Trip Guidebook: Austin, Tex., Gulf Coast Assoc. Geol. Socs., p. 82–100, illus., 1964.

The only quantitatively significant accumulation of nonskeletal carbonate sediments along the Texas coast is the oolitic beach sand in this area, which is completely separated from the Gulf of Mexico by barrier islands. The hypersalinity of the water and the wave action on the beaches are considered both necessary and sufficient for the formation of the ooids. The intensity of wave action also seems to control their detailed petrography and that of coated grains, but the exact mechanisms of precipitation are uncertain.—G.D.C.

Bennett, Hugh. *See* Roethlisberger, Hans. 0059

0054 **Benson, Richard H.; Kaesler, Roger L.** The Benson-Kaesler Bolapipe dredge: Micropaleontology, v. 11, no. 3, p. 369–372, illus., 1965.

A small dredge for collecting microorganisms in Recent sediment in shallow and relatively inaccessible areas is designed on the principle of an oceanographic pipe dredge. It is small enough to be easily carried and can be thrown up to distances of 120 feet by a method similar to that used in throwing the Patagonian bolas.—Authors' abstract

Bentley, Charles R. *See* Roethlisberger, Hans. 0059

0023 **Berger, J.; Blanchard, J. E.; Keen, M. J.; McAllister, R. E.; Tsong, C. F.** Geophysical observations on sediments and basement structure underlying Sable Island, Nova Scotia: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 959–965, illus., 1965.

Sable Island is on the edge of the continental shelf off Nova Scotia, Canada. Refraction profiles suggest geologic column beneath Sable Island as follows, compressional velocity and thickness of sediments given: unconsolidated layer, 5,900 ft/sec, 3,250 feet; semiconsolidated layer, 10,000 ft/sec., 3,950 feet; and consolidated layer 12,500 ft/sec, 7,500 feet for a total thickness of sediment of 14,750 feet. Compressional velocity of basement beneath is 19,000 ft/sec. A basement ridge proposed to underlie the shelf margin to the southwest, off Halifax, appears to continue northeast beneath Sable Island. Consolidated sediment appears to cross over the ridge and continue toward the continental slope.—S.P.S.

0111 **Berger, Kermit C.** Introductory soils: New York, Macmillan Co., 371 p., illus., tables, 1965.

This textbook is an introduction to the study of soil science to furnish the basic facts to college and high school students who have had no previous training in the subject. It covers the nature, properties, relationships, and classification of soils, the chemical elements present and their role, soil and plant testing, fertilizers, and soil conservation and erosion control.—M.C.

0052 **Berggren, W. A.** Some problems of Paleocene-Lower Eocene planktonic foraminiferal correlations: Micropaleontology, v. 11, no. 3, p. 278–300, illus., 1965.

Comparative studies have demonstrated that an approximate correlation can be made between the Paleocene-Lower Eocene planktonic foraminiferal zonations which have been recently proposed in the Western Hemisphere and the southwestern part of the Soviet Union (Crimea and Caucasus). The stage names Midway, Sabine

(=Wilcox) and Claiborne commonly used in Gulf Coast stratigraphy do not correspond to the classic time-stratigraphic subdivisions in western Europe.—Author's abstract

0048 **Bergstein, A.; Sestak, J.; Kitzinger, E.** Phases in the spinel region of the system CuO_x–MnO_y–FeO_z: Am. Mineralogist, v. 50, nos. 5–6, p. 762–765, illus., 1965.

The system was investigated in air by thermogravimetric, dilatometric, and X-ray measurements at temperatures between 20–1200°C. Phases encountered were cubic spinel, tetragonally distorted spinel, delafossite, tenorite, and hematite.—E.H.R.

0180 **Bernstein, Lowell.** Fossil birds from the Dominican Republic: Florida Acad. Sci. Quart. Jour., v. 28, no. 3, p. 271–284, 1965.

Forty-two species of fossil birds are described briefly from a cave deposit near the top of Cerro de San Francisco, an isolated limestone hill in Provincia San Rafael, near the Haitian border. From stratum 2, pre-Columbian but not older than 2000 B. C., 224 bones represent 26 species; from stratum 3, probably late Pleistocene, 539 bones represent 32 species. The species of this fauna (families Rallidae through Fringillidae) are probably all living, but many represent first fossil records. Changes in humerus size in two species indicate that the climate of stratum 3 was warmer than that of stratum 2. The species are found today in fresh-water marshes, open country, lowland scrub, and mountain forests.—V.M.J.

0335 **Berryhill, Richard A.** Smackover fields, hard to find or just easy to miss?—Case history, Midway Field, Lafayette County, Arkansas: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 137–142, illus., 1964.

This field is the State's largest producer of oil from the Smackover Formation of Jurassic age. Since its discovery in January 1942, the cumulative production has exceeded 45,000,000 bbl; engineering estimates place the ultimate recovery by both primary and secondary methods at 90,000,000 bbl, by depletion time in 1989. This prolific field is just one of many in this Smackover trend stretching from East Texas across southern Arkansas and into Mississippi. Numerous subsurface maps of the structure were in existence and at least five different seismic surveys were conducted prior to a successful seismic and drilling program. The geology is summarized.—G.D.C.

0172 **Beus, Stanley S.** Permian fossils from the Kaibab Formation at Flagstaff, Arizona: Plateau, v. 38, no. 1, p. 1–5, illus., 1965.

A Permian fauna including 17 species of mollusks, four brachiopod species and one trilobite was obtained from the upper Kaibab Formation in an excavation on the Arizona State College campus. A new gastropod form represented by two internal molds is tentatively assigned to the Busyconidae, a family previously known only from the Cretaceous and Cenozoic.—Author's abstract

0058 **Bingler, Edward C.** Precambrian geology of La Madera quadrangle, Rio Arriba County, New Mexico: New Mexico Bur. Mines and Mineral Resources Bull. 80, 132 p., illus., tables, geol. map, 1965.

Three episodes of dislocation in the Precambrian rocks of this area in order of occurrence are deformation by the shearing and flowage of regional metamorphism, isoclinal folding transecting the trend of the first deformation, and cataclastic dislocation producing wide-spaced "step folds" with nearly vertical axial-plane cleavage. The mineral assemblages in this complex indicate paragenesis first by the regional metamorphism, second by thermal and/or hydrothermal metamorphism, and third by cataclastic structures which cut across minerals of the second metamorphism. Pegmatite intrusives have created aureoles in the enclosing schist by metasomatism. Thin section data are the basis for most of the petrologic conclusions.—G.D.C.

0345 **Birchwood, Ken M.** Mud volcanoes in Trinidad: Inst. Petroleum Rev., v. 19, no. 221, p. 164–167, illus., 1965.

An island which rose out of the sea in Erin Bay, off Chatham, on the south coast of Trinidad, in August 1964 reached a height of 15 feet above high water level and covered an area of 7 1/2 acres. It resulted from the extrusion of an estimated 13 million cu feet of mud originating 10,000 feet below, from the mid-Miocene Lengua Formation. Such mud volcanoes also occurred in 1911 and 1928; all three formed on the crest of the Southern Range Anticline, in line with others on shore. Gas escaping from several vents on the island was found to be almost 95 percent methane, and similar to that occurring at a well drilled half a mile to the southwest. Wave erosion had reduced the island to 4.6 acres by October.—G.D.C.

Blanchard, J. E. *See* Berger, J. 0023

0088 **Blanchard, Richard L.** U^{234}/U^{238} ratios in coastal marine waters and calcium carbonates: Jour. Geophys. Research, v. 70, no. 16, p. 4055-4061, illus., tables, 1965.

Samples of water and live molluscan shells collected at seven locations on the seacoast of the United States and samples of silt, water, and shells from an estuary were analyzed for U-234, U-238, Ca, and salinity or crystal structure. All the water samples had U-activity ratios close to the 1.15 value accepted for an oceanic environment, indicating that the normally higher U-activity ratio of rivers does not appreciably increase the ratio of coastal waters. The activity ratios of all but two shell samples were similar to those of the surrounding water and to the oceanic 1.15 value. The application of the results to age determinations by the uranium series equilibrium method is described.—D.B.V.

0042 **Bloss, F. Donald.** Pitfall in determining 2V in micas: Am. Mineralogist, v. 50, nos. 5-6, p. 789-792, table, 1965.

Interlayerings of twinned mica individuals can give significantly lower 2V values than single crystals. Offsets in the higher order isochromes of an interference figure are the best indicators of such interlayerings; single crystals do not show these offsets. Measurements of 2V should be made on single crystals.—R.S.F.

0179 **Boggess, Durward H.; Davis, Christian F.; Coskery, O. J.** Water-table, surface-drainage, and engineering soils map of the Burrsville area, Delaware: U.S. Geol. Survey Hydrol. Inv. Atlas HA-135, scale 1:24,000, 1965.

The map sheet includes a hydrograph showing average depth to water in 13 water-table wells in Delaware, and tables of soils classification, results of laboratory analyses of soil samples, and characteristics of the engineering soil types in the Burrsville area.—M.C.M.

0308 **Bonar, Robert E.** Crab Lake Field, Cameron Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 6-6d, illus., 1964.

0331 **Bonner, A. S., Jr.** South Oberlin Field, Allen Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 30-30d, illus., 1964.

0288 **Bouma, Arnold H.** Notes on X-ray interpretation of marine sediments: Marine Geology, v. 2, no. 4, p. 278-309, illus., 1964.

X-ray radiography is a technique recently introduced in the study of sediments. The method is very useful for analyzing details of primary and secondary sedimentary structures or to detect their presence in unconsolidated as well as in consolidated deposits. Prints of radiographs made from vertical slices of samples collected in Recent marsh, submarine canyons and estuarine environments are used to discuss the interpretation of the visible structures. [Marsh and submarine canyon samples are largely from Mexico and off California].—Author's abstract

0006 **Bowers, S. A.; Hanks, R. J.** Reflection of radiant energy from soils: Soil Sci., v. 100, no. 2, p. 130-138, illus., 1965.

With both kaolinite and bentonitic clays, the reflectance increased exponentially as particle size decreased. The magnitude of reflectance change was very similar with both clays. By applying the kaolinite reflectance data to Gates' direct solar energy distribution curve, one would expect energy absorption to increase by at least an additional 14.6 percent of that in the incident beam when the particle size is increased from 22μ to 2650μ.—J.W.H.

0198 **Bowie, S. H. V.** Minutes of meeting of the IMA Commission on Ore Microscopy held in New Delhi on 14th December, 1964: Econ. Geology, v. 60, no. 6, p. 1326–1329, 1965.

The Commission reached some agreement on form and content of tables of quantitative data for ore microscopy, reflectivity standards, and instrumentation for reflectivity and indentation hardness measurements.—W.S.W.

0222 **Boyd, Don R.; Dyer, Byron F.** Frio barrier bar system of South Texas: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 309–322, illus., 1964.

Subsurface data from wells drilled in Aransas, Nueces, Refugio, and San Patricio Counties discloses a barrier bar system in the Frio formation (Oligocene), in which continental shelf, bar, and lagoonal environments are recognizable. During a slow withdrawal of the seas a massive bar, analogous to the present day Padre–Mustang–St. Joseph–Matagorda Islands complex, developed with the deposition of clastic sands transported by longshore currents from the southwest where extensive deltas were being built by the ancestral Rio Grande. Prolific oil and gas production has been established from sands in each of the three environments. The success of future exploration of the Frio is largely contingent upon a thorough understanding of the depositional framework of this bar.—G.D.C.

0167 **Boynton, G. R.; Popenoe, Peter; Zandle, G. L.** Aeromagnetic map of the Great Barrington quadrangle, Berkshire County, Massachusetts: U.S. Geol. Survey Geophys. Inv. Map GP-530, scale 1:24,000, 1965.

The aeromagnetic survey of the Great Barrington quadrangle was flown at 500 feet above ground; contour interval is 20 gammas.—M.C.M.

0175 **Boynton, G. R.; Popenoe, Peter; Zandle, G. L.** Aeromagnetic map of part of the Ashley Falls quadrangle, Berkshire County, Massachusetts, and Litchfield County, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-526, scale 1:24,000, 1965.

The aeromagnetic survey of the Ashley Falls quadrangle was flown at 500 feet above ground; contour interval is 20 gammas.—M.C.M.

0176 **Boynton, G. R.; Popenoe, Peter; Zandle, G. L.** Aeromagnetic map of part of the Bashbish Falls quadrangle, Massachusetts, Connecticut, and New York: U.S. Geol. Survey Geophys. Inv. Map GP-527, scale 1:24,000, 1965.

The aeromagnetic survey of the Bashbish Falls quadrangle was flown at 500 feet above ground; contour intervals are 20 and 100 gammas.—M.C.M.

0020 **Branson, Carl C.** Holotype of type species of *Mortoniceras*: Oklahoma Geology Notes, v. 25, no. 9, p. 252–256, illus., 1965.

The ammonite genus *Mortoniceras* Meek, 1876, is based upon the species *Ammonites vespertinus* Morton, 1834. Adkins pointed out in an abstract (1944) that the species *M. vespertinum* is valid, is the true type species, and that it came from Choctaw County, Okla. Geologists have confused the nomenclature and generic concept. It is unfortunate that the genus *Mortoniceras* was founded on a poor type specimen. Until good specimens are found the genus is understood only as a concept.—G.D.C.

0021 **Branson, Carl C.** New species of *Conocardium*: Oklahoma Geology Notes, v. 25, no. 9, p. 247–251, illus., 1965.

A large species of the bivalve genus *Conocardium* is abundant in Missourian rocks of Oklahoma and Texas. The specific name, *C. lanterna*, is derived from Latin, in reference to its shape. The holotype is described and specimens from various locations are illustrated.—G.D.C.

0360 **Brecke, E. A.** Origin of the Illinois–Kentucky fluorspar deposits [reply to discussion by A. J. Erickson, Jr., 1965]: Econ. Geology, v. 60, no. 5, p. 1070–1073, 1965.

Erickson's discussion (Econ. Geology, v. 60, p. 384–385, 1965) of earlier paper by Brecke oversimplifies relationships of fluorspar and igneous rocks.—W.S.W.

Brietkrietz, Alex. *See* McMurtrey, R. G. 0285

0257 **Brigger, A. L.; Hanna, G. Dallas.** A review of *Kittonia*, a genus of diatoms: California Acad. Sci. Occasional Paper 50, 10 p., illus., 1965.

The diatom genus *Kittonia* (family Biddulphiae) is reviewed, to bring together all known records of these excellent marker fossils for the Upper Cretaceous and Eocene. Eleven species, plus two species of related genera, are described briefly and illustrated. The type species, *K. elaborata*, well known from the New Zealand diatomites, is from deposits not younger than Oligocene; no *Kittonia* has ever been found in Miocene or younger strata. Five species are described from Eocene deposits of Barbados, West Indies, including *K. tetrapoda* n. sp.; three species are from the Upper Cretaceous Moreno Shale of Panoche Hills, Calif., including *K. morenoensis* n. sp.—V.M.J.

0030 **Brobst, Donald A.; Ward, Frederick N.** A turbidimetric test for barium and its geologic application in Arkansas: Econ. Geology, v. 60, no. 5, p. 1020–1040, illus., tables, 1965.

Sample is fused with carbonate flux, leached with hot sodium–carbonate solution; resulting barium carbonate is dissolved in dilute HCl and precipitated as sulfate. Turbidity of solution, measured against standards, gives useful results in the range 500–10,000 ppm barium. This simple, rapid, and inexpensive geochemical–prospecting method has been used to study barite deposits in Arkansas. "Deposits in the commonly steeply dipping Stanley Shale tend to be uniform in grade and are surrounded by thin halos of outwardly decreasing barium content, rarely more than 150 feet thick". In this gently dipping Trinity Group, deposits and haloes are irregular in shape and barium content.—W.S.W.

Broecker, Wallace S. *See* Kaufman, Aaron. 0339

Brown, J. A. *See* Fox, W. T. 0128

0191 **Brown, John S.** Lead isotopes of pegmatites, granites, and ores: Econ. Geology, v. 60, no. 6, p. 1167–1184, illus., tables, 1965.

Lead from pegmatites is isotopically similar to ore leads of comparable age. Lead from granitic rocks associated with lead ores has more erratic isotopic composition, and commonly contains more radiogenic lead. This suggests that the chief source of lead in ores and pegmatites is not the granitic rocks themselves but their host rocks, and that some sort of distillation process, driven by the heat of the granitic rock, produces both pegmatites and ores.—W.S.W.

0085 **Brown, R. E.; Raymond, J. R.** Geophysical seismic evaluation study at Hanford: Battelle–Northwest, Richland, Wash., Pacific Northwest Lab. Rept. BNWL–47, 40 p., illus., tables, 1964[1965].

Seismic exploration was carried out in the vicinity of Hanford, Wash., to obtain detailed geological and hydrological information in this area, already explored by more than 700 wells, for radioactive waste disposal purposes. The basalt surface and some individual flows were readily detected along two of three refraction lines and along reflection lines where it was below 600 feet deep. The surface of the Pleistocene Ringold Formation also was detected but not individual beds within

it nor the Pleistocene–Recent glaciofluvial sediments. The ground-water table was not detected. Refraction methods proved the most usable and least expensive techniques. Rotary drilling and in-hole logging gave good control on geology at tie points.—V.S.N.

0116 **Brune, Gunnar.** Anhydrite and gypsum problems in engineering: Eng. Geology, v. 2, no. 1, p. 26–38, illus., 1965.

Designing dams with dry sediment pools or sand diaphragms may offset problems caused by hydration of anhydrite deposits to gypsum common to Texas, New Mexico, and Oklahoma. Near Carlsbad, N. Mex., leakage from Lake McMillan through gypsum beds causes cracking and subsidence of the McMillan Escarpment, but collapse of gypsiferous foundations here probably can be prevented by prewetting and preconsolidating the soils. In Oklahoma at a floodwater-retarding structure in the Washita River watershed, the cavernous gypsum is more likely to collapse than a cavernous limestone because of its greater solubility. Sinkholes here can be filled with boulders and a grout cap and covered by select compacted materials. Other minor problems can be handled similarly.—M.C.

0015 **Buerger, M. J.** Image methods in crystal-structure analysis, *in* Advanced methods of crystallography: London and New York, Academic Press, p. 1–24, illus., 1964.

To give a brief but integrated account of the solution for crystal structures that makes modern use of Patterson space, this paper falls into two parts. The first is concerned with "image algebra", the mathematical background; the second with its application to extracting the electron density from a Patterson synthesis. Examples of the use of minimum functions are berthierite and coesite, one in two dimensions and the other in three dimensions. As to how complicated a crystal can be solved by this means, a first image point must be found to start it, and this should preferably be single. Pitfalls in the procedure and the limit of solvability are considered, and the importance of understanding the relation between crystal symmetry and Patterson symmetry.—G.D.C.

Burckley, Raymond A. *See* Ramsey, William L. 0092

0113 **Cabaniss, Gerry H.** Geophysical studies of playa basins, [Chap.] 5 *in* Geology, mineralogy, and hydrology of U.S. playas: U.S. Air Force Cambridge Research Labs., Environmental Research Paper 96 (AFCRL-65-266), p. 123–147, illus., tables, 1965.

Geophysical studies made by several universities and government agencies of some of the interior basins of California and Nevada have revealed that many are partially filled with thick 5,000 to 10,000 ft sequences of Cenozoic sediments and volcanics. Consideration of various geophysical methods (seismic, gravimetric, magnetic, and electrical) and the results from preliminary surveys lead to the conclusion that the seismic techniques are most adaptable to the study of playas, but that electrical methods require additional testing to determine their efficacy in this particular geological environment. Gravity profiles across four playas permit some qualitative interpretation of the structure of the underlying bedrock but show only minor anomalies associated with density variations in the playa sediments.—Author's abstract

0358 **Cabri, L. J. P.** Discussion of "Empressite and stuetzite redefined" by R. M. Honea (1964): Am. Mineralogist, v. 50, nos. 5–6, p. 795–801, tables, 1965.

Phase relations in the system Au–Ag–Te are applied to natural tellurides. Honea's redefinition of empressite is questioned. X-ray data are given for a phase between Ag_2Te and $Ag_{5-x}Te_3$ which is stable only between 120°–460°C.—E.H.R.

0197 **Cadwell, Donald E.; Weiblen, Paul W.** Diamond disc preparation of polished thin sections for electron microprobe analysis: Econ. Geology, v. 60, no. 6, p. 1320–1325, 1965.

Grinding is carried out on diamond discs and polishing uses diamond slurry on polyethylene film in a vibratory polisher. Automatic equipment is used for slow stages. The section is thinned by two-step diamond-disc grinding.—W.S.W.

0141 **Cailleux, André; Wuttke, Krystyna.** Morphoscopie des sables quartzeux dans l'Ouest des Etats-Unis d'Amérique du Nord [with English abstract]: Bol. Paranaense Geografia, nos. 10–15, p. 79–87, tables, 1964.

In California and Arizona sands, unworn quartz grains usually prevail, as often happens in regions with high relief or semi-arid conditions. However, some signs of wind-action (round and frosted, dull grains) are to be seen especially in some dune sands, and reworked pediments; and some water-action on the smooth and shiny grains of some beach sands, while others are almost entirely unaltered. G.D.C.

0188 **Caldwell, Loren T.** Mineral content in water from fifty three water-wells in DeKalb and Sycamore quadrangles, Illinois: Illinois Acad. Sci. Trans., v. 57, no. 4, p. 216–223, illus., tables, 1964.

Water samples were analyzed for mineral content to determine the relation between total mineral hardness values and the aquifers from which they were pumped. The wells were divided into three groups on the basis of the aquifer in which they were based, namely 38 in the Galena-Plattsville, 1 each in St. Peters Sandstone and Galesville Sandstone, and 14 in glacial drift. Only the Galena-Platteville group showed any relation between total hardness values and aquifers.—M.C.

0199 **Camargo, O. F.** Operators in Arkoma prefer gamma-density log: Oil and Gas Jour., v. 63, no. 41, p. 188–192, illus., table, 1965.

Air or gas drilling is used in the Arkoma basin in Oklahoma and Arkansas and the best method of detecting gas saturation and porosity in these gas-filled holes is by using a density log in combination with the induction survey.—S.E.F.

Cameron, Alexander R. *See* Hacquebard, Peter A. 0256

0164 **Cameron, H. L.** The shifting sands of Sable Island: Geog. Rev., v. 55, no. 4, p. 463–476, illus., 1965.

The attenuate Sable Island, approximately 21 mi long, lies along the margin of the continental shelf 180 mi east of Halifax, Nova Scotia. It is the emergent top of a mass of glacial sand averaging 30 mi wide and 100 mi long, deposited during the Wisconsin maximum on the continental shelf and reworked by interaction of the Labrador Current and Gulf Stream during postglacial sealevel rise. Geophysical work indicates 1,200 feet of sand on bedrock, suggesting accumulation in a depression in bedrock which nearby is only 350 to 400 feet below sea level. Aerial photography and early records indicate that in 200 yr Sable Island has lost 9 mi on its west end and gained 11 mi on its east. A terrain map indicates character of the dunal topography. Fresh water is reported available throughout the island somewhat above high tide. Disturbance of the natural biota by man is discussed.—L.L.R.

Campbell, Douglas D. *See* Jerome, S. E. 0057

0200 **Campbell, Ian; Troxel, Bennie W.** Geologic hazards—Urban mapping program of the Division of Mines and Geology: California Div. Mines and Geology Mineral Inf. Service, v. 18, no. 8, p. 161–163, 1965.

Earthquakes, landslides, and subsidence "hazards" are some of the geologic features which concern engineering, petroleum, and ground-water geologists, each of whom, by the nature of his specialization, may have little opportunity to delineate broader relationships. The application of geochemistry and geophysics to geologic mapping are examples of recently improved techniques of study. Perhaps the most significant development is the enlarged scale of mapping used in areas of increasing population density—some even one inch to 400 feet—and referred to in Illinois as

"environmental" and in California as "urban" mapping. The California Division of Mines and Geology program is reviewed.—G.D.C.

Campbell, W. A. *See* Selleck, D. J. 0133

0369 **Canada Geological Survey.** Aeromagnetic map, Adair Lake, Manitoba: Canada Geol. Survey Geophysics Paper 1077, scale 1:63,360, 1965.

0370 **Canada Geological Survey.** Aeromagnetic map, Hutton Lake, Manitoba: Canada Geol. Survey Geophysics Paper 1092, scale 1:63,360, 1965.

0371 **Canada Geological Survey.** Aeromagnetic map, Canica Island, Quebec: Canada Geol. Survey Geophysics Paper 1414, scale 1:63,360, 1965.

0372 **Canada Geological Survey.** Aeromagnetic map, Lac Madeleine, Quebec: Canada Geol. Survey Geophysics Paper 1415, scale 1:63,360, 1965.

0373 **Canada Geological Survey.** Aeromagnetic map, Wetetnagami Lake, Quebec: Canada Geol. Survey Geophysics Paper 1425, scale 1:63,360, 1965.

0374 **Canada Geological Survey.** Aeromagnetic map, Lac de la Ligne, Quebec: Canada Geol. Survey Geophysics Paper 1426, scale 1:63,360, 1965.

0375 **Canada Geological Survey.** Aeromagnetic map, Puskitamika Lake, Quebec: Canada Geol. Survey Geophysics Paper 1427, scale 1:63,360, 1965.

0376 **Canada Geological Survey.** Aeromagnetic map, Lac Quevillon, Quebec: Canada Geol. Survey Geophysics Paper 1434, scale 1:63,360, 1965.

0377 **Canada Geological Survey.** Aeromagnetic map, Granite Narrows, Quebec: Canada Geol. Survey Geophysics Paper 1444, scale 1:63,360, 1965.

0378 **Canada Geological Survey.** Aeromagnetic map, Rivière Coigny, Quebec: Canada Geol. Survey Geophysics Paper 1454, scale 1:63,360, 1965.

0379 **Canada Geological Survey.** Aeromagnetic map, Opeongo Lake, Ontario: Canada Geol. Survey Geophysics Paper 1455, scale 1:63,360, 1965.

0380 **Canada Geological Survey.** Aeromagnetic map, Lake Lavieille, Ontario: Canada Geol. Survey Geophysics Paper 1456, scale 1:63,360, 1965.

0381 **Canada Geological Survey.** Aeromagnetic map, Brent, Ontario–Quebec: Canada Geol. Survey Geophysics Paper 1457, scale 1:63,360, 1965.

0382 **Canada Geological Survey.** Aeromagnetic map, Maganasipi River, Quebec–Ontario: Canada Geol. Survey Geophysics Paper 1458, scale 1:63,360, 1965.

0383 **Canada Geological Survey.** Aeromagnetic map, Lac Bleu, Quebec: Canada Geol. Survey Geophysics Paper 1459, scale 1:63,360, 1965.

0384 **Canada Geological Survey.** Aeromagnetic map, Lac Sairs, Quebec: Canada Geol. Survey Geophysics Paper 1460, scale 1:63,360, 1965.

0385 **Canada Geological Survey.** Aeromagnetic map, Ogascanan Lake, Quebec: Canada Geol. Survey Geophysics Paper 1461, scale 1:63,360, 1965.

0386 **Canada Geological Survey.** Aeromagnetic map, Winawiash Lake, Quebec: Canada Geol. Survey Geophysics Paper 1462, scale 1:63,360, 1965.

0387 **Canada Geological Survey.** Aeromagnetic map, Lac Nodier, Quebec: Canada Geol. Survey Geophysics Paper 1463, scale 1:63,360, 1965.

0388 **Canada Geological Survey.** Aeromagnetic map, Lac Mourier, Quebec: Canada Geol. Survey Geophysics Paper 1464, scale 1:63,360, 1965.

0389 **Canada Geological Survey.** Aeromagnetic map, Algonquin, Ontario: Canada Geol. Survey Geophysics Paper 1465, scale 1:63,360, 1965.

0390 **Canada Geological Survey.** Aeromagnetic map, Burntroot Lake, Ontario: Canada Geol. Survey Geophysics Paper 1466, scale 1:63,360, 1965.

0391 **Canada Geological Survey.** Aeromagnetic map, Kiosk, Ontario: Canada Geol. Survey Geophysics Paper 1467, scale 1:63,360, 1965.

0392 **Canada Geological Survey.** Aeromagnetic map, Mattawa, Ontario–Quebec: Canada Geol. Survey Geophysics Paper 1468, scale 1:63,360, 1965.

0393 **Canada Geological Survey.** Aeromagnetic map, Lac Beauchêne, Ontario–Quebec: Canada Geol. Survey Geophysics Paper 1469, scale 1:63,360, 1965.

0394 **Canada Geological Survey.** Aeromagnetic map, Grindstone Lake, Quebec: Canada Geol. Survey Geophysics Paper 1470, scale 1:63,360, 1965.

0395 **Canada Geological Survey.** Aeromagnetic map, Ostaboninguè Lake, Quebec: Canada Geol. Survey Geophysics Paper 1471, scale 1:63,360, 1965.

0396 **Canada Geological Survey.** Aeromagnetic map, Belleterre, Quebec: Canada Geol. Survey Geophysics Paper 1472, scale 1:63,360, 1965.

0397 **Canada Geological Survey.** Aeromagnetic map, Lac Simard, Quebec: Canada Geol. Survey Geophysics Paper 1473, scale 1:63,360, 1965.

0398 **Canada Geological Survey.** Aeromagnetic map, Lac Roger, Quebec: Canada Geol. Survey Geophysics Paper 1474, scale 1:63,360, 1965.

0399 **Canada Geological Survey.** Aeromagnetic map, South River, Ontario: Canada Geol. Survey Geophysics Paper 1476, scale 1:63,360, 1965.

0400 **Canada Geological Survey.** Aeromagnetic map, Powassan, Ontario: Canada Geol. Survey Geophysics Paper 1477, scale 1:63,360, 1965.

0401 **Canada Geological Survey.** Aeromagnetic map, North Bay, Ontario: Canada Geol. Survey Geophysics Paper 1478, scale 1:63,360, 1965.

0402 **Canada Geological Survey.** Aeromagnetic map, Temiscaming, Ontario–Quebec: Canada Geol. Survey Geophysics Paper 1479, scale 1:63,360, 1965.

0403 **Canada Geological Survey.** Aeromagnetic map, Ottertail Creek, Ontario–Quebec: Canada Geol. Survey Geophysics Paper 1480, scale 1:63,360, 1965.

0404 **Canada Geological Survey.** Aeromagnetic map, Fabre, Quebec–Ontario: Canada Geol. Survey Geophysics Paper 1481, scale 1:63,360, 1965.

0405 **Canada Geological Survey.** Aeromagnetic map, Ville-Marie, Quebec–Ontario: Canada Geol. Survey Geophysics Paper 1482, scale 1:63,360, 1965.

0406 **Canada Geological Survey.** Aeromagnetic map, Angliers, Quebec: Canada Geol. Survey Geophysics Paper 1483, scale 1:63,360, 1965.

0407 **Canada Geological Survey.** Aeromagnetic map, Lac Varrière, Quebec: Canada Geol. Survey Geophysics Paper 1484, scale 1:63,360, 1965.

0408 **Canada Geological Survey.** Aeromagnetic map, Magnetawan, Ontario: Canada Geol. Survey Geophysics Paper 1485, scale 1:63,360, 1965.

0409 **Canada Geological Survey.** Aeromagnetic map, Golden Valley, Ontario: Canada Geol. Survey Geophysics Paper 1486, scale 1:63,360, 1965.

0410 **Canada Geological Survey.** Aeromagnetic map, Nipissing, Ontario: Canada Geol. Survey Geophysics Paper 1487, scale 1:63,360, 1965.

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0411 **Canada Geological Survey.** Aeromagnetic map, Sturgeon Falls, Ontario: Canada Geol. Survey Geophysics Paper 1488, scale 1:63,360, 1965.

0412 **Canada Geological Survey.** Aeromagnetic map, Marten Lake, Ontario: Canada Geol. Survey Geophysics Paper 1489, scale 1:63,360, 1965.

0413 **Canada Geological Survey.** Aeromagnetic map, Ingall Lake, Ontario: Canada Geol. Survey Geophysics Paper 1490, scale 1:63,360, 1965.

0414 **Canada Geological Survey.** Aeromagnetic map, Timagami, Ontario: Canada Geol. Survey Geophysics Paper 1491, scale 1:63,360, 1965.

0415 **Canada Geological Survey.** Aeromagnetic map, Cobalt, Ontario–Quebec: Canada Geol. Survey Geophysics Paper 1492, scale 1:63,360, 1965.

0416 **Canada Geological Survey.** Aeromagnetic map, New Liskeard, Ontario–Quebec: Canada Geol. Survey Geophysics Paper 1493, scale 1:63,360, 1965.

0417 **Canada Geological Survey.** Aeromagnetic map, Englehart, Ontario–Quebec: Canada Geol. Survey Geophysics Paper 1494, scale 1:63,360, 1965.

0418 **Canada Geological Survey.** Aeromagnetic map, Sans Souci, Ontario: Canada Geol. Survey Geophysics Paper 1495, scale 1:63,360, 1965.

0419 **Canada Geological Survey.** Aeromagnetic map, Parry Sound, Ontario: Canada Geol. Survey Geophysics Paper 1496, scale 1:63,360, 1965.

0420 **Canada Geological Survey.** Aeromagnetic map, Pointe-au-Baril, Ontario: Canada Geol. Survey Geophysics Paper 1497, scale 1:63,360, 1965.

0421 **Canada Geological Survey.** Aeromagnetic map, Noganosh Lake, Ontario: Canada Geol. Survey Geophysics Paper 1498, scale 1:63,360, 1965.

0422 **Canada Geological Survey.** Aeromagnetic map, Noelville, Ontario: Canada Geol. Survey Geophysics Paper 1499, scale 1:63,360, 1965.

0423 **Canada Geological Survey.** Aeromagnetic map, Verner, Ontario: Canada Geol. Survey Geophysics Paper 1500, scale 1:63,360, 1965.

0424 **Canada Geological Survey.** Aeromagnetic map, Glen Afton, Ontario: Canada Geol. Survey Geophysics Paper 1501, scale 1:63,360, 1965.

0425 **Canada Geological Survey.** Aeromagnetic map, Lake Timagami, Ontario: Canada Geol. Survey Geophysics Paper 1502, scale 1:63,360, 1965.

0426 **Canada Geological Survey.** Aeromagnetic map, Obabika Lake, Ontario: Canada Geol. Survey Geophysics Paper 1503, scale 1:63,360, 1965.

0427 **Canada Geological Survey.** Aeromagnetic map, Lady Evelyn Lake, Ontario: Canada Geol. Survey Geophysics Paper 1504, scale 1:63,360, 1965.

0428 **Canada Geological Survey.** Aeromagnetic map, Elk Lake, Ontario: Canada Geol. Survey Geophysics Paper 1505, scale 1:63,360, 1965.

0429 **Canada Geological Survey.** Aeromagnetic map, Charlton Station, Ontario: Canada Geol. Survey Geophysics Paper 1506, scale 1:63,360, 1965.

0430 **Canada Geological Survey.** Aeromagnetic map, Naiscoot River, Ontario: Canada Geol. Survey Geophysics Paper 1507, scale 1:63,360, 1965.

0431 **Canada Geological Survey.** Aeromagnetic map, Key Harbour, Ontario: Canada Geol. Survey Geophysics Paper 1508, scale 1:63,360, 1965.

0432 **Canada Geological Survey.** Aeromagnetic map, Delamere, Ontario: Canada Geol. Survey Geophysics Paper 1509, scale 1:63,360, 1965.

0433 **Canada Geological Survey.** Aeromagnetic map, Coniston, Ontario: Canada Geol. Survey Geophysics Paper 1510, scale 1:63,360, 1965.

0434 **Canada Geological Survey.** Aeromagnetic map, Capreol, Ontario: Canada Geol. Survey Geophysics Paper 1511, scale 1:63,360, 1965.

0435 **Canada Geological Survey.** Aeromagnetic map, Milnet, Ontario: Canada Geol. Survey Geophysics Paper 1512, scale 1:63,360, 1965.

0436 **Canada Geological Survey.** Aeromagnetic map, Pilgrim Creek, Ontario: Canada Geol. Survey Geophysics Paper 1513, scale 1:63,360, 1965.

0437 **Canada Geological Survey.** Aeromagnetic map, Smoothwater Lake, Ontario: Canada Geol. Survey Geophysics Paper 1514, scale 1:63,360, 1965.

0438 **Canada Geological Survey.** Aeromagnetic map, Collins Inlet, Ontario: Canada Geol. Survey Geophysics Paper 1515, scale 1:63,360, 1965.

0439 **Canada Geological Survey.** Aeromagnetic map, Lake Panache, Ontario: Canada Geol. Survey Geophysics Paper 1516, scale 1:63,360, 1965.

0440 **Canada Geological Survey.** Aeromagnetic map, Copper Cliff, Ontario: Canada Geol. Survey Geophysics Paper 1517, scale 1:63,360, 1965.

0441 **Canada Geological Survey.** Aeromagnetic map, Chelmsford, Ontario: Canada Geol. Survey Geophysics Paper 1518, scale 1:63,360, 1965.

0442 **Canada Geological Survey.** Aeromagnetic map, Venetian Lake, Ontario: Canada Geol. Survey Geophysics Paper 1519, scale 1:63,360, 1965.

0443 **Canada Geological Survey.** Aeromagnetic map, Thorlake, Ontario: Canada Geol. Survey Geophysics Paper 1520, scale 1:63,360, 1965.

0444 **Canada Geological Survey.** Aeromagnetic map, Opikinimika Lake Ontario: Canada Geol. Survey Geophysics Paper 1521, scale 1:63,360, 1965.

0445 **Canada Geological Survey.** Aeromagnetic map, Whitefish Falls, Ontario: Canada Geol. Survey Geophysics Paper 1522, scale 1:63,360, 1965.

0446 **Canada Geological Survey.** Aeromagnetic map, Espanola, Ontario: Canada Geol. Survey Geophysics Paper 1523, scale 1:63,360, 1965.

0447 **Canada Geological Survey.** Aeromagnetic map, Cartier, Ontario: Canada Geol. Survey Geophysics Paper 1524, scale 1:63,360, 1965.

0448 **Canada Geological Survey.** Aeromagnetic map, Pogamasing, Ontario: Canada Geol. Survey Geophysics Paper 1525, scale 1:63,360, 1965.

0449 **Canada Geological Survey.** Aeromagnetic map, Low Water Lake, Ontario: Canada Geol. Survey Geophysics Paper 1526, scale 1:63,360, 1965.

0450 **Canada Geological Survey.** Aeromagnetic map, Westree, Ontario: Canada Geol. Survey Geophysics Paper 1527, scale 1:63,360, 1965.

0451 **Canada Geological Survey.** Aeromagnetic map, Gogama, Ontario: Canada Geol. Survey Geophysics Paper 1528, scale 1:63,360, 1965.

0452 **Canada Geological Survey.** Aeromagnetic map, Mattagami Lake, Ontario: Canada Geol. Survey Geophysics Paper 1529, scale 1:63,360, 1965.

0453 **Canada Geological Survey.** Aeromagnetic map, Kenogaming Lake, Ontario: Canada Geol. Survey Geophysics Paper 1530, scale 1:63,360, 1965.

0454 **Canada Geological Survey.** Aeromagnetic map, Sinclair Lake, Ontario: Canada Geol. Survey Geophysics Paper 1531, scale 1:63,360, 1965.

0455 **Canada Geological Survey.** Aeromagnetic map, MacLeod Lake, Manitoba: Canada Geol. Survey Geophysics Paper 1686, scale 1:63,360, 1965.

0456 **Canada Geological Survey.** Aeromagnetic map, Sheet 64 P/3, Manitoba: Canada Geol. Survey Geophysics Paper 1687, scale 1:63,360, 1965.

0457 **Canada Geological Survey.** Aeromagnetic map, Sheet 64 P/2, Manitoba: Canada Geol. Survey Geophysics Paper 1688, scale 1:63,360, 1965.

0458 **Canada Geological Survey.** Aeromagnetic map, Sheet 64 P/1, Manitoba: Canada Geol. Survey Geophysics Paper 1689, scale 1:63,360, 1965.

0459 **Canada Geological Survey.** Aeromagnetic map, Sheet 54 M/4, Manitoba: Canada Geol. Survey Geophysics Paper 1690, scale 1:63,360, 1965.

0460 **Canada Geological Survey.** Aeromagnetic map, Sheet 54 M/3, Manitoba: Canada Geol. Survey Geophysics Paper 1691, scale 1:63,360, 1965.

0461 **Canada Geological Survey.** Aeromagnetic map, Point of the Woods, Manitoba: Canada Geol. Survey Geophysics Paper 1692, scale 1:63,360, 1965.

0462 **Canada Geological Survey.** Aeromagnetic map, Caribou Lake, Manitoba: Canada Geol. Survey Geophysics Paper 1696, scale 1:63,360, 1965.

0463 **Canada Geological Survey.** Aeromagnetic map, Mink Rapids, Manitoba: Canada Geol. Survey Geophysics Paper 1697, scale 1:63,360, 1965.

0464 **Canada Geological Survey.** Aeromagnetic map, Long Lake, Manitoba: Canada Geol. Survey Geophysics Paper 1698, scale 1:63,360, 1965.

0465 **Canada Geological Survey.** Aeromagnetic map, Hubbart Point, Manitoba: Canada Geol. Survey Geophysics Paper 1699, scale 1:63,360, 1965.

0466 **Canada Geological Survey.** Aeromagnetic map, Lac des Canots, Quebec: Canada Geol. Survey Geophysics Paper 1987, scale 1:63,360, revised 1965; originally published 1957.

0467 **Canada Geological Survey.** Aeromagnetic map, Baie du Poste, Quebec: Canada Geol. Survey Geophysics Paper 1988, scale 1:63,360, revised 1965; originally published 1957.

Carlson, Clarence. *See* Anderson, Sidney B. 0284

Carozzi, Albert V. *See* Carss, Brian W. 0202

0151 **Carpenter, E. W.; Flinn, E. A.** Attenuation of teleseismic body waves: Nature, v. 207, no. 4998, p. 745–746, 1965.

A possible reason for difficulty in observing short-period (about 1 sec) shear waves at angular distances of 25°–100° is suggested. It is shown that at such periods, S-wave amplitudes are attenuated by a factor of 10^4 more than P-wave amplitudes; at 6-sec period the corresponding factor is only 5. Most of the attenuation occurs in the low-velocity layer at depths of the order of 100 km; thus examination of P- and S-wave spectrums from suitably chosen seismic events might be valuable in determining the lateral variability of the low-velocity layer.—D.B.V.

0065 **Carpenter, Everett.** Reminiscences of Everett Carpenter, geologist: Shale Shaker, v. 16, no. 1, p. 17–22, 1965.

This is an autobiographical letter written to Edgar W. Owen, which tells of geological mapping in the early days of petroleum exploration in Oklahoma and other midcontinental areas of the United States, and the gradual recognition of its value by the oil companies.—G.D.C.

0202 **Carss, Brian W.; Carozzi, Albert V.** Petrology of Upper Devonian pelletoidal limestones, Arrow Canyon Range, Clark County, Nevada: Sedimentology, v. 4, no. 3, p. 197–224, illus., tables, 1965.

This carbonate sequence of rocks has 10 calcilutite, pelletoidal calcarenite, and sandstone microfacies. Pellets are more mechanical than fecal in origin. Sandstone layers, especially in Arrow Canyon Formation, are extrabasinal clastic material. There were nine recognizable phases of environmental energy. The lower part of the section indicates an environment where conditions were quiet enough for precipitation of calcium carbonate as the main sediment. A biostrome, probably resulting from filling up of the sedimentation basin and corresponding increase in energy of environment, occurs in this same section; ideal cycle 1 corresponds to the section with the biostrome and ideal cycle 2, to the part without it. The carbonate environment evolution followed a pattern of overall shallowing similar to the Florida Bay area today.—M.C.

0078 **Case, Gerard Ramon.** An occurrence of the sawfish, *Onchopristis dunklei* in the Upper Cretaceous of Minnesota: Minnesota Acad. Sci. Jour., v. 32, no. 3, p. 183, illus., 1965.

Rostral teeth of the middle Cretaceous sawfish *Onchopristis dunklei* were recently recovered at a location in the Mesabi Iron Range near Keewatin, Minn. This represents the second reported occurrence of the species in the United States. Author's abstract

Chao, E. C. T. *See* Mead, Cynthia W. 0046

Chapman, Carleton A. *See* Gaudette, Henri E. 0183

0014 **Chelf, C. R.; Fisher, W. L.** Sand and gravel (constructional), *in* Rock and mineral resources of East Texas: Texas Univ. Bur. Econ. Geology Rept. Inv. 54, p. 320–326, illus., tables, 1965.

This paper briefly summarizes data on the occurrences, production, and marketing of sand and gravel resources in East Texas.—G.D.C.

0265 **Chelini, J. M.; Smith, R. L.; Lawson, D. C.** Progress report on clays and shales of Montana, 1962–1964: Montana Bur. Mines and Geology Bull. 45, 43 p., illus., tables, 1965.

This report, fourth of a series of progress reports on a survey designed to catalog the clay and shale deposits of the State and to determine possible uses, if any, of the raw materials sampled, contains a description of 72 samples. The clays are tested for use as ceramic raw materials, as possible sources of expanded shale (lightweight aggregate for concrete), and as possible sources of alumina for the production of metallic aluminum.—Authors' abstract

0282 **Chelini, J. M.** Limestone, dolomite, and travertine in Montana: Montana Bur. Mines and Geology Bull. 44, 53 p., illus., tables, 1965.

Carbonate rock, a low-cost mineral commodity used by many industries, is abundant in Montana, especially in the western part. Thick stratigraphic units consisting of carbonate rock of diverse texture and chemical composition tend to form cliffs and prominent ridges, which are readily mineable. The Meagher (Cambrian) and Lodgepole and Mission Canyon (Mississippian) Formations contain immeasurable reserves. Carbonate rock is also a minor but significant constituent of Belt (Precambrian), Kootenai (Cretaceous), and Cenozoic rocks. Dolomite is most common in Cambrian strata, high-purity limestone in Mississippian and Pennsylvanian rocks, and travertine exclusively in Cenozoic deposits. Samples collected totaled 86. They were analyzed for CaO, MgO, insoluble, Al_2O_3, Fe_2O_3, P_2O_5, and S, and the results tabulated.—Author's abstract

Chilingar, George V. *See* Robertson, John O., Jr. 0203

Christ, Charles L. *See* Garrels, Robert M. 0149

Christie, R. L. *See* Kerr, J. W. 0028

Clark, Joan R. *See* Milton, Charles. 0356

0124 **Clayton, Lee; Laird, Wilson M.; Klassen, R. W.; Kupsch, W. O.** Intersecting minor lineations on Lake Agassiz Plain: Jour. Geology, v. 73, no. 4, p. 652–656, illus., 1965.

Intersecting minor ridges on the plain of glacial Lake Agassiz were probably pushed up by floating lake ice and apparently are not primarily the result of permafrost, wave action and running water, or a fracture pattern in the underlying bedrock, as previously suggested. Associated minor intersection grooves were formed also by dragging lake ice. They are essentially identical to grooves forming in Great Slave Lake in recent times.—Authors' abstract

Clayton, Robert N. *See* Sharma, Taleshwar. 0279

Clemons, Russell E. *See* McLeroy, Donald F. 0099

Cloud, William K. *See* Steinbrugge, Karl V. 0343

0310 **Codina, Julian O. P.** East Moss Lake Field, Calcasieu Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 8–8b, illus., 1964.

0214 **Coleman, James M.; Gagliano, Sherwood M.** Cyclic sedimentation in the Mississippi River deltaic plain: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 67–80, illus., 1964.

Examples of major cycles of detrital and nondetrital deposition are provided by the modern and pre-modern lobate deltas of the Mississippi River sediments. With a shift in the source point, an abandoned delta undergoes coastal retreat and inundation, during which reworked and *in situ* deposits accumulate over the detrital lens. Two such examples of pre-modern deltas studied are the St. Bernard and Sale-Cypremort lobes of the Mississippi Delta. Subdeltas or crevasses are small versions of the major deltaic cycle and can be used as a model. Facies relationships explored in a hypothetical sequence of overlapping cycles are compared with an actual vertical section taken at Fort Jackson, La.—G.D.C.

Conkin, Barbara M. *See* Conkin, James E. 0053

0053 **Conkin, James E.; Conkin, Barbara M.; Pike, James W.** Mississippian foraminifera of the United States—Pt. 2, The Hannibal Formation of northeastern Missouri and western Illinois: Micropaleontology, v. 11, no. 3, p. 335–359, illus., tables, 1965.

This fauna described from eight localities in Missouri and five localities in Illinois, consists of 30 species (one new and five unidentifiable) belonging to 15 genera and 7 families. The genus *Blastammina* Eisenack, 1932, is recognized outside the Baltic region for the first time, and its age extended into the lower Mississippian. The age of the Hannibal Formation is definitely Kinderhookian on the basis of arenaceous forams. Its fauna, although similar to that of other formations in northeastern Missouri and western Illinois, is most closely related to that of the Northview Formation of southwestern Missouri.—G.D.C.

0258 **Coode, Alan M.** A note on oceanic transcurrent faults: Canadian Jour. Earth Sci., v. 2, no. 4, p. 400–401, illus., 1965.

Transcurrent faults have been recorded in the Pacific Ocean, off the west coast of the United States where their presence has been inferred from studies of ocean magnetic anomalies, and in fracture zones of ridges. Displacements of several hundred km are not rare and, when fault lines intersect a continental boundary, they disappear and either cease to exist or continue under the continental sial.

The anomalies suggest that production of new crust occurs at the same rate everywhere along the ridge and, while either variable mineral content or varying magnetic field will generate anomalies, the latter seems more probable. Fracture zones occur on all ridges but appear to be most concentrated where crustal tension is minimum or two tension sources overlap midway between the bifurcation points or sharp bends, under which crustal tension is greatest. It is suggested that fracture zones develop over two upwelling convection currents.—M.C.

0325 **Cook, Floyd.** Midland Field, Acadia Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 23–23c, illus., 1964.

0079 **Cook, John C.** Seismic mapping of underground cavities using reflection amplitudes: Geophysics, v. 30, no. 4, p. 527–538, illus., tables, 1965.

Underground cavities having dimensions of tens to hundreds of meters should markedly reflect artificial seismic waves and locally obstruct reflections from deeper horizons. Attempts have been made to apply these principles to delineate solution-mined cavities in bedded salt. In one area results from a brine-filled cavity 300 m below the surface were unclear, but in a seismically favorable area strong "shadows" were found in a reflection survey of cavities 500 m below the surface. At present the method requires good reflecting horizons both above and below the layer to be explored. Among other applications, the method should be useful in mapping natural caverns and nuclear-blast cavities.—D.B.V.

Copeland, D. A. *See* Baird, A. K. 0359

0159 **Córdoba, Diego A.** Carta geológica de México—Hoja Apizolaya, Estados de Zacatecas y Durango: México, D. F., México Univ. Nac. Autónoma, Inst. Geología, scale 1:100,000, sections, text, 1964.

Eighteen stratigraphic units in the Apizolaya area are presented in a correlation chart, and discussed in some detail. Intrusive rocks are exposed in the Sierras de Teyra, de San Julián, and de Peribánez. The basement structure, folds, domes, and faults in the area are described and the historical geology from Precambrian to Pleistocene is outlined. Mineral resources are gold, talc, asbestos, barite, phosphate, and copper.—M.C.M.

0273 **Cordova, R. M.; Subitzky, Seymour.** Ground water in northern Utah Valley, Utah—A progress report for the period 1948–63: Utah State Engineer Tech. Pub. 11, 38 p., illus., tables, 1965.

The valley is part of an elongated basin that is flanked on either side by the Wasatch Range, and contains Upper Tertiary and Quaternary unconsolidated deposits. Three artesian aquifers are found in the Tertiary and the Pleistocene pre-Lake Bonneville deposits while unconfined ground water occupies the Lake Bonneville Group and post-Provo deposits. Recharge to the ground-water reservoir comes from seepage from waterways and irrigated land, precipitation, and subsurface flow from bedrock of the Wasatch Range, while discharge is by drains and springs, wells, seepage into waterways, evapotranspiration, and sewer systems, with additional unknown amounts by seepage into Utah Lake and subsurface flow through Jordan Narrows. Discharge has exceeded recharge and water levels have declined in wells and aquifers but this does not indicate depletion of the ground-water reservoir. Water quality is good for most uses.—M.C.

Corpus Christi Geol. Society. *See* Gulf Coast Assoc. Geol. Societies. 0005

Coskery, O. J. *See* Boggess, Durward H. 0179

0066 **Curray, Joseph R.** Structure of the continental margin off central California: New York Acad. Sci. Trans., ser. 2, v. 27, no. 7, p. 794–801, illus., 1965.

The structural framework of the continental margin off central California has been determined by means of acoustic reflection to consist of thick accumulations of shelf and slope deposits over and behind a basement ridge, locally known to be granitic.

Where this ridge is deeply buried, a wide and presumably thick continental rise has formed. Large scale sliding has locally modified steeper portions of the continental slope, especially seaward of the basement ridge. This structure differs in degree of development, not in basic kind, from the east coast of the United States.—Author's abstract

0317 **Cutright, Charles L.** Intracoastal City Field, Vermilion Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 15–15c, illus., 1964.

0037 **Dalrymple, Don W.** Calcium carbonate deposition associated with blue-green algal mats, Baffin Bay, Texas: Inst. Marine Sci. Pub., v. 10, p. 187–200, illus., 1965.

A distinctive grain type, termed "algal micrite," is forming in association with blue-green algal mats in the Baffin Bay area. This grain type consists essentially of microcrystalline aragonite intermeshed with mucilaginous organic material, and is believed to form by direct precipitation from super-saturated sea water within the lower zones of the mat. The precipitation may be induced by bacterial decomposition of the algal mat.—Author's abstract

0362 **Davidson, C. F.** A possible mode of origin of strata-bound copper ores: Econ. Geology, v. 60, no. 5, p. 942–954, 1965.

Attention is directed to the regional and stratigraphical association of strata-bound copper ores with evaporites, and arguments are presented in support of the thesis that intra-stratal brines derived from the diagenesis and lixiviation of salt deposits have circulated to a depth of two or three miles, leached copper from primary sulfide disseminations of magmatic origin in regions with a high geothermal gradient, and on ascending to shallower and cooler environments redeposited the metal where chemical and structural conditions were favorable.—Author's abstract

Davis, Christian F. *See* Boggess, Durward H. 0179

0168 **Davis, W. E.; Kinoshita, W. T.; Robinson, G. D.** Bouguer gravity, aeromagnetic, and generalized geologic map of the western part of the Three Forks Basin, Jefferson, Broadwater, Madison, and Gallatin Counties, Montana: U.S. Geol. Survey Geophys. Inv. Map GP-497, 2 sheets, scale 1:62,500, separate text, 1965.

Sheet 1, gravity and geologic map, has a contour interval of 40 feet; sheet 2, aeromagnetic map, has contour intervals of 20, 100, 200, and 500 gammas. Geophysical and geologic data indicate that the Jefferson Canyon thrust continues east and northeast beneath sedimentary deposits to join the Highway thrust exposed south of Three Forks Junction. High magnetic gradients south of Willow Creek are inferred to be the expression of a concealed metamorphic sedimentary-rock contact that represents the postulated Willow Creek fault zone. There is no geophysical evidence of Cenozoic block faulting and deep basin filling in the area. The contacts between the basin deposits and pre-Cenozoic sedimentary rocks seem to be gentle and sinuous and most likely are depositional.—M.C.M.

0007 **DeJong, E.; Warkentin, B. P.** Water retention by clay-glass bead mixtures: Soil Sci., v. 100, no. 2, p. 108–111, illus., 1965.

The water retention by clay-glass bead mixtures at pF 4–5 was an approximate linear function of amount of clay present in the mixture and independent of the structure of the clay. At lower pF values the amount of moist content was dependent on the clay structure.—J.W.H.

Delavault, Robert E. *See* Warren, Harry V. 0269

0075 **DeLong, Richard M.** Geology of the Kensington quadrangle, Ohio: Ohio Div. Geol. Survey Rept. Inv. 55, scale 1:24,000, section, text, 1965.

Upper Freeport and Mahoning coal beds have been mined in the Kensington quadrangle. The most persistent clay is the Thornton which is quite thin; the thicker

deposits (Cow Run Shale and Round Knob Clay) have not been tested for ceramic purposes. Brush Creek and Buffalo Shales are used in the manufacture of brick and Ames Limestone has been quarried for agricultural lime. The Norristown and Mechanicstown oil pools produced from the Berea and Cussewago Sandstones respectively, but are no longer active. Salt deposits (Silurian) that aggregate 200–300 feet underlie the quadrangle at an elevation of 3,200–3,500 feet below sea level. Sand and gravel were deposited by Illinoian glacial meltwater in the valley of Sandy Creek, and there is some active quarrying.—M.C.M.

0150 **DeLuca, F. A.; Hoffman, J. F.; Lubke, E. R.** Chloride concentration and temperature of the waters of Nassau County, Long Island, New York: New York Water Resources Comm. Bull. GW 55, 35 p., illus., tables, 1965.

Chloride concentrations reported from 1895 to 1962 in the principal water-bearing units of Nassau County range from 2 to 9,200 ppm in upper Pleistocene deposits, 2 to 12,900 ppm in the Jameco Gravel of Pleistocene age, 1 to 16,700 ppm in the Magothy(?) Formation, and 1 to 2,800 ppm in the Lloyd Sand Member of the Raritan Formation of Cretaceous age. Concentrations in streams ranged from 5 to 25 ppm and in bays and estuaries, from several hundred to 16,000 ppm. Seawater contamination is limited to the near-shore areas on the north (Long Island Sound) and south (Atlantic Ocean) sides of the county and comes from excess pumping or the effect of extra-high tides. Temperature of the natural ground water ranges from about 50°F in the upper Pleistocene deposits to about 70°F in the Lloyd Sand Member.—M.C.

Desborough, George A. *See* Baxter, James W. 0161

Dever, Garland R., Jr. *See* Price, Robert C. 0205

Díaz G., Teodoro. *See* Pérez Fernández, Raúl. 0234

0311 **Dobie, C. Walter.** Erath Field, Vermilion Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 9–9e, illus., 1964.

0266 **Dodd, R. T., Jr.; VanSchmus, W. R.; Marvin, U. B.** Merrihueite—A new alkali-ferromagnesian silicate from the Mezö-Madaras chondrite: Science, v. 149, no. 3687, p. 972–974, tables, 1965.

Merrihueite, a new K–Na–Fe–Mg silicate mineral occurs with iron-rich olivine, iron-poor pyroxene, and nickel-iron in a few chondrules of the Mezö-Madaras chondrite. The refractive index lies between 1.559 and 1.592; the birefringence for each composition is low to moderate. X-ray powder data for merrihueite are nearly identical to those for osumilite, and very similar to those for a synthetic K–Mg silicate. It is named in honor of the late Craig M. Merrihue, meteoriticist, of the Smithsonian Astrophysical Observatory.

0076 **Dodd, Robert T., Jr.** Preferred orientation of chondrules in chondrites: Icarus, v. 4, no. 3, p. 308–316, illus., tables, 1965.

Twenty H- and L-group chondrites, showing various degrees of recrystallization, were examined for preferred chondrule orientation. All of the samples but three possess a foliation, which is poorly developed in two chondrites and pronounced in the others. Most of the strongly foliate samples also possess a lineation in the plane of foliation. As the foliation in these chondrites shows no systematic change in intensity with the degree of recrystallization, it is interpreted as a relict sedimentary fabric which was imposed during the deposition of the chondrules. The same can be said, with less conviction, of lineation.—Author's abstract

Donaldson, J. Roger. *See* Hacquebard, Peter A. 0256

0321 **Duchin, Ralph D.** Krotz Springs field, St. Landry Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 19–19d, illus., 1964.

0145 **Durham, Clarence O., Jr.** Iron ore of central North Louisiana: Louisiana Geol. Survey Geol. Bull. 41, 127 p., illus., tables, 1964.

Beds of sideritic glauconite in the upper Claiborne sequence, middle Eocene, of this area, weather to brown ore consisting of clay and limonite veins and ledges. Because of the flat-lying character of surface beds on the D'Arbonne Platform, the ore beds are exposed in wide areas of five parishes; they occur as lentils at four or more levels in a stratigraphic sequence 150 feet thick. This investigation included both a regional reconnaissance study and detailed mapping of 12 local districts. Large scale structural and isopach maps present a fairly accurate estimate of reserves, which include over 44 million tons of brown dirt and over 16 million tons of green ore.—G.D.C.

Dwornik, Edward J. *See* Milton, Charles. 0356

Dyer, Byron F. *See* Boyd, Don R. 0222

0296 **Eaton, J. P.** On the standardization of geophysical observations at volcanoes: Bull. Volcanol., v. 27, p. 417–419, 1964.

The objectives of geophysical study of volcanoes are (1) to determine the gross structure of the volcano, how and why it erupts, and the sources of the magma; and (2) to determine when and where the next eruption will occur. Although similar instruments and techniques can be used to study volcanoes of different types and location, flexibility must be maintained in the deployment of instruments and interpretation of data. In discussing standardization, emphasis should be on upgrading observations to a minimum quality and quantity rather than on the exact format in which the results are to be presented. A program based on the geophysical observations made at Kilauea is outlined; it should be modified for different types of volcanoes in other regions.—D.B.V.

0233 **Eaton, R. W.** Jurassic development, Upper Gulf Coastal areas of northeast Mexico and southern United States [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 233, 1964.

0312 **Eby, Thomas J., Jr.** Franklin Field, St. Mary Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 10–10d, illus., 1964.

0117 **Eck, William; Redfield, Robert C.** Engineering geology problems at Sanford Dam, Borger, Texas: Eng. Geology, v. 2, no. 1, p. 15–25, illus., table, 1965.

Filled chimneys near the damsite on the Canadian River raised the question of possible excessive seepage from the proposed reservoir. These ancient sinkholes extend from the surface 460 feet to the Blaine Formation of Permian age, and are in gypsum, anhydrite, thin shale and dolomite, and soft sand. The filling is fine sand, silt, clay, and slumped Permian "red beds." The chimneys apparently developed by a process of natural stoping, through which caved material was drawn off gradually at the bottom by ground-water erosion. Slumping of overlying beds and in-place deposition progressively filled surface depressions. Strata adjacent to the chimneys also shows abnormal dips and slumping. The filling appears to be sufficiently tight and complete to prevent reservoir leakage through chimneys.—M.C.

0103 **Ellis, Brooks F.; Messina, Angelina R.** Catalogue of index Foraminifera—V. 1. Lepidocyclinids and miogypsinids: New York, Am. Mus. Nat. History, [755] p., illus., 1965.

The three-volume catalog of larger index Foraminifera is the result of separating these forms from the general file and bringing it up to date with original and subsequent illustrations. The larger discoidal group were chosen first because they are among the most useful index Foraminifera, and because the chaotic state of the literature makes them the most difficult to use. This first volume contains illustrations for and bibliographic references to 50 species of miogypsinids and 107

species of lepidocyclinids. A list of valid names, with their synonyms, precedes the section on lepidocyclinids.—G.D.C.

Enbysk, B. J. *See* Nayudu, Y. R. 0286

0242 **Engelke, Lester P.** Large glacial erratics in northeast Iowa: Iowa Acad. Sci. Proc. 1964, v. 71, p. 280–283, illus., table, 1965.

The location of large glacial erratics of gneiss and granite in northeast Iowa, specifically in the tri-county area of Bremer–Fayette–Chickasaw counties is described. Discussed are the possible origin, size, location, detectability on survey photos, and some historical features. Action to provide for protection of these glacial relics against destruction is urged.—Author's abstract

0307 **Evans, Robert L.** Choupique Field, Calcasieu Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 4–4d, illus., 1964.

Everson, William A. *See* Shearer, Robert E. 0170

0215 **Feder, Allen M.** Let's use more of the electromagnetic spectrum: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 35–49, illus., 1964.

Today airborne systems can record valuable geological data produced by radiation in the ultraviolet, infrared, radar, and other spectral regions. Images collected by these advanced sensors are presented, including examples of geologic structure, lithology, drainage and ground water patterns; geothermal deposits and pipe lines; and thermal and sediment transport patterns in water bodies. The advanced sensors have high mobility and less dependence on time-of-day and meteorologic conditions than do conventional aerial photographic operations, so that thousands of square miles of terrain can be mapped in hours rather than months. A radar mosaic of the Arbuckle Mountains demonstrates this. The new sensors are of greatest benefit where applied in combination.—G.D.C.

0264 **Ferguson, Stewart A.** Geology of the eastern part of Baird township, District of Kenora: Ontario Dept. Mines Geol. Rept. 39, 47 p., illus., tables, geol. map, 1965.

This map-area forms the southwestern part of the Red Lake gold-mining area where there has been substantial mineral production. The oldest group of country rocks are metabasalts overlain by a thick unit of welded tuff. Tuff beds containing ore zones are interbedded with major rock units at or near the contact. Intrusive rocks are varied, the major granitic ones being the Killala–Baird batholith and the Faulkenham Lake stock. The axial trends in the older rocks of the northwestern part of the map-area are in that direction, but in the younger rocks on the southern part the trends are almost at right angles to this, becoming more conformable near the contact. Gold deposits occur as veins and also as mineralized zones within tuff beds, production having been from the latter type.—G.D.C.

0090 **Ferguson Wood, E. J.** Marine microbial ecology: New York, Reinhold Publishing Co., 243 p., illus., 1965.

This comprehensive survey—of interest to workers in oceanography, marine biology, planktonology, petroleum geology and sedimentology—analyses the central position of microbes in the productivity of the seas, both as they restore nutrients to the waters and as they aid in the deposition, composition, and general movement through the oceans of sediment materials. Because estuaries are so much more easily affected by climate, by the juxtaposition of water and sediment, and by their shallowness relatively even to the continental shelf, oceanic and estuarine environments are treated separately.—G.D.C.

Fischer, William. *See* Badgley, Peter C. 0270

0135 **Fisher, Richard V.** Settling velocity of glass shards: Deep-Sea Research, v. 12, no. 3, p. 345–353, illus., table, 1965.

Laboratory studies were made to compare the velocity of settlement of quartz with that of small fragments of volcanic glass to better understand the sedimentation history of deposits having a significant component of glass shards. Materials used were bubble-wall shards from Kansas Pearlette Ash, pumice shards from Crater Lake pumice, crushed commercial silica foam, and crushed glass scoria. Except for pumice fragments, different types of glass shards settle with velocities considerably less than quartz at the 1/2 mm size but at about the same velocity as quartz in sizes less than 1/16 mm, so that pipette analyses based on Stokes' law are valid only for samples with abundant bubble-wall shards. In applications to submarine volcaniclastic sedimentation, for areas of successive eruptions, feldspar or quartz may reach sea bottom at the same time as sand-sized glass shards from a previous eruption.—M.C.

0011 **Fisher, W. L.; Garner, L. E.** Clay and clay materials, *in* Rock and mineral resources of East Texas: Texas Univ. Bur. Econ. Geology Rept. Inv. 54, p. 79-195, illus., tables, 1965.

This area accounts for about 40 percent of the total Texas production of ceramic clay and about 60 percent of its nonceramic clay. Their occurrence is widespread, and mineral composition relatively pure kaolinite, montmorillonite, and illite, with complete gradation and intermixing. Kaolinitic clays occur in non-marine units of the Wilcox Group, Queen City and Sparta Formations. Illitic clays are in partly marine units of the Wilcox Group of the Sabine Uplift. Montmorillonite occurs in Upper Cretaceous and Tertiary marine units in the northwestern and central parts and associated with Tertiary volcanic sediments in the southern part. Various tests and analyses are tabulated by counties.—G.D.C.

0013 **Fisher, W. L.; Owen, D. E.** Phosphorite, *in* Rock and mineral resources of East Texas: Texas Univ. Bur. Econ. Geology Rept. Inv. 54, p. 299-304, illus., tables, 1965.

Thin but persistent beds of phosphorite occur in the basal parts of several Upper Cretaceous and Paleocene rock units within the coastal plain of Texas, including the northern part of east Texas. Conglomerates with small concretions of phosphorite occur in Paleocene glauconitic units. Principle horizons are described briefly, and geographic distribution is indicated on a sketch map. Analyses indicate low-grade phosphate rock. Reserves, though not adequately delineated, are probably large.—G.D.C.

Fisher, W. L. *See* Chelf, C. R. 0014

0366 **Fisher, W. L.; Schofield, D. A.; Garner, L. E.** Methodology—App. B *in* Rock and mineral resources of East Texas: Texas Univ. Bur. Econ. Geology Rept. Inv. 54, p. 357-360, 1965.

This contribution concerns the methods of field sampling and laboratory testing of materials for this inventory study.—G.D.C.

0367 **Fisher, W. L.** Rock and mineral resources of East Texas: Texas Univ. Bur. Econ. Geology Rept. Inv. 54, 439 p., illus., tables, geol. map, 1965.

This report treats the rock and mineral resources of 42 counties in a 33,000 sq mi area of eastern and northeastern Texas. The nature of the study required that samples for testing be obtained from exposures; a limited number were taken from shallow auger holes. Many localities remain untested. Oil and natural gas and water are excluded except to consider their use and availability in mining, producing, and processing other rock and mineral deposits. Low-grade iron is the principal metallic ore; other resources are chiefly industrial minerals and construction materials. Several contributing authors are cited separately.—G.D.C.

0219 **Flawn, Peter T.** Basement rocks of the Texas Gulf Coastal Plain: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 271-275, illus., 1964.

This paper, frankly speculative, extends concepts developed in the better known Texas part of the Gulf Coastal Plain eastward where information on the basement

rocks is even less complete. It proceeds from the conclusions of an earlier paper (Flawn et al, 1961) on the foundered Ouachita System, descriptions of which are summarized. On the basis of bore-hole data its sinuous extent can be proved from southwestern Alabama to the Mexican border, and beyond for a minimum length of 400 mi and width of 250 mi. Geophysical evidence added to this suggests a southeastern extent of several hundred miles. The area of subsidence of the Ouachita System corresponds to the Gulf Coastal Plain. The writer questions a layered Precambrian-Paleozoic contact in Texas.—G.D.C.

Flinn, E. A. *See* Carpenter, E. W. 0151

0146 **Flint, Richard Foster.** Introduction, *in* The Quaternary, V. 1: New York, Interscience Publishers, p. xi-xxii, table, 1965.

The Quaternary System, a major time-stratigraphic unit, encompasses the youngest strata in the whole rock sequence and includes sediments being deposited today, a factor which makes study of its sediments significant for understanding environments and manners of deposition of older strata. The name was proposed by Desnoyers in 1829. Two methods of defining and subdividing the Quaternary are based on either the evolutionary development of organisms or the variations in climate, and both are accomodated in North American usage, for, while no single system of terminology and nomenclature has been adopted for the stratigraphic units, the system proposed by the American Commission on Stratigraphic Nomenclature is used by most North American geologists. Radiometric dating, particularly Carbon-14, is of prime importance in fixing, in time, the positions of points or distinctive deposits within the glacial and non-glacial physical units.—M.C.

0232 **Forgotson, James M., Jr.; Iglehart, Charles F.; Rivette, John L.** Current computer usage by exploration geologists [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 235, 1964.

0049 **Fournier, Robert O.** Montmorillonite pseudomorphic after plagioclase in a porphyry copper deposit: Am. Mineralogist, v. 50, nos. 5-6, p. 771-777, illus., tables, 1965.

Chemical analyses, optical, X-ray, differential thermal, and density investigations are presented for three samples, and show that the pseudomorphs, while intermediate in composition between beidellite and montmorillonite, are closer to montmorillonite in this and other respects.—J.R.C.

0228 **Fowler, Phillip T.** Basement faults and Smackover structure: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 179-191, illus., 1964.

A post-Buckner (Upper Jurassic) zone of structural discordance that extends probably throughout the Gulf coastal plain separates stratal sequences of different tectonic style. The younger sequence was deformed by superficial gravity tectonics with horizontal extension on normal faults. The older sequence was deformed during deposition of the Smackover-Buckner unit by horizontal compression which caused strike-slip movement on pre-existing vertical faults originating in the crust. Productive Smackover anticlines are part of a multi-order wrench-fault system. The basement faults moved vertically before and after the episode of strike-slip movement.—Author's abstract

0166 **Fox, Paul Jeffrey; Heezen, Bruce C.** Sands of the Mid-Atlantic Ridge: Science, v. 149, no. 3690, p. 1367-1370, illus., table, 1965.

Sands collected at 24 locations along the crest of the Mid-Atlantic Ridge between 58°S and 38°N consist predominantly of olivine diopsidic augite, hypersthene, enstatite, amphibole, quartz, plagioclase, and volcanic glass, suggesting an olivine tholeiitic source. Eight cores contain relatively pure mineral sands; three of these cores reflect local volcanic activity. In 16 cores the manganese-coated mineral grains are mixed in a current-winnowed foraminiferal sand or ooze.—Authors' abstract

0128 **Fox, W. T.; Brown, J. A.** The use of time-trend analysis for environmental interpretation of limestones: Jour. Geology, v. 73, no. 3, p. 510-518, illus., 1965.

A study is made of 105 limestone thin sections to test the feasibility of using time-trend analysis to compare several attributes within a single measured section. Two smoothing equations are applied to the thin-section data, one which retains the prominent maxima and minima of the original data, and another which brings out the underlying trends of sedimentation. Trends in lithology of the limestones are then compared with trends in fossil distribution. Certain parameters including the ratio of broken-to-whole fossils, the ratio of sparite to micrite plus dolomite, and the abundances of certain fossil groups are used to interpret the energy level in the depositional environment.—Authors' abstract

0268 **Fox, William T.** FORTRAN and FAP program for calculating and plotting time-trend curves using an IBM 7090 or 7094/1401 computer system: Kansas Geol. Survey Spec. Distrib. Pub. 12, 24 p., illus., tables, 1964.

This program is used to compute and plot a series of smoothed or graduated curves based on a sequence of geologic observations taken from a traverse or stratigraphic section. Nine smoothing formulae correspond to cycles of increasing magnitude within the data. The total sum of squares of deviations from the smoothed curve is used to compute the percent of total variability accounted for by each curve. A series of third-order polynomials are fit to the data by least-squares analysis. The program is limited to 500 observations on each of 10 variables, but can be modified to handle 500 on 30 or 1,500 on 10 variables. It compiles from FORTRAN and FAP source decks in 4.8 minutes. To compute all nine curves for 100 observations on a single variable takes 2 minutes.—G.D.C.

0341 **Fraser, Ronald.** The habitable earth: New York, Basic Books, Inc., 155 p., illus., tables, 1964.

This volume on the Earth and its interior and origin is a basic source book on the Earth's evolution for both the geologist and science-minded layman. It is based on some of the best geophysical and oceanographic references in the recent literature, and presents current evidence from the fields of geology, geophysics, seismology, and biochemistry, including methods used, in five chapters: crust, mantle, and core; geophysical relationships of Earth's interior zones and its origin; mountain building; origin of the orogenic belts and radioactive dating; ocean floor, structures and features; drifting continents, theory and history; and sea and sky, the meteorologic and oceanographic aspects. A short glossary defines the principal geologic and geophysical terms.—M.C.

0252 **Fraunfelter, George H.** *Gennaeocrinus* sp. from the Glen Park Formation of northeastern Missouri: Illinois Acad. Sci. Trans., v. 58, no. 3, p. 204–205, illus., 1965.

The author believes this crinoid to be the first specimen of the genus reported from the Glen Park Formation. It comes from a road cut near Louisiana, Mo. The genus *Gennaeocrinus* usually is considered to be restricted to Devonian rocks, thus suggesting that the Glen Park Formation, commonly assigned to the Mississippian, may more properly belong to the Devonian.—M.C.

0137 **Friedman, Gerald M.** In defence of point counting analysis—Hypothetical experiments versus real rocks [discussion of Van der Plas' reply, 1965]: Sedimentology, v. 4, no. 3, p. 252–253, 1965.

Friedman finds that he agrees with many points made by Van der Plas in his reply [ibid., v. 4, no. 3, p. 249–251, 1965] to Friedman's discussion [ibid., v. 4, no. 3, p. 247–249, 1965] dealing with the use of point-counting analysis technique in grain-size studies. Van der Plas has maintained that the technique has serious limitations and leads to doubtful results in size analysis. Friedman recognizes the limitations but believes that the technique is still very useful. Basically the studies by the two are not directly comparable because Van der Plas used hypothetical experiments with hypothetical quartz sand while Friedman used consolidated sandstone. Friedman suggests that perhaps they should reverse their roles so that he would study hypothetical sand and Van der Plas, consolidated sandstone, for then they would have a common basis for making comparisons.—M.C.

0275 **Friedman, Gerald M.** In defence of point counting analysis, a discussion [of paper by Van der Plas, 1962]—Grain-size determination and chemical analysis with the petrographic microscope: Sedimentology, v. 4, no. 3, p. 247–249, 1965.

In making a comparison of sieving and thin-section methods for grain-size analysis, Van der Plas (ibid., v. 1, p. 145–157, 1962) claimed that discrepancies between results obtained by the two techniques have passed almost unnoticed and therefore that point-counting methods in granulometric analysis lead to doubtful results. However, Friedman and others have shown in a series of papers that use of a point-counting technique for grain-size analysis and for determining chemical composition of rocks leads to results directly comparable to those obtained by other methods. Friedman thinks, perhaps, that Van der Plas' study is based too much on theoretical analysis rather than practical results, so that the differences between his experience and that of Van der Plas may be one of degree rather than of kind.—M.C.

0050 **Frondel, Clifford; Ito, Jun.** Composition of palermoite: Am. Mineralogist, v. 50, nos. 5–6, p. 777–779, tables, 1965.

A new analysis of the type specimen of palermoite shows in percent $Li_2O = 4.00$, $Na_2O = 1.32$, $K_2O = 0.10$, $MgO = 0.10$, $CaO = 1.39$, $SrO = 12.93$, $BaO = 0.10$, $Fe_2O_3 = 0.30$, $Al_2O_3 = 30.83$, $P_2O_5 = 42.89$, $H_2O^- = 0.3$, $H_2O^+ = 5.36$, total = 99.69. This conforms to $(Li, Na)_2(Sr, Ca)\ Al_4(PO_4)_4(OH)_4$. A least square refinement of the X-ray powder d-spacings yields $a = 7.315 \pm 0.004$, $b = 15.849 \pm 0.009$, $c = 11.556 \pm 0.006$ Å (orthorhombic), $Z = 4$.—M.L.L.

0348 **Frondel, Clifford.** Johannsenite and manganoan hortonolite from Franklin, N. J.: Am. Mineralogist, v. 50, nos. 5–6, p. 780–781, tables, 1965.

Colorless fibrous aggregates of johannsenite at Franklin differ from brown johannsenite crystals in being enriched in manganese and depleted in iron and zinc: $SiO_2 = 48.29$, $CaO = 22.59$, $MgO = 2.84$, $MnO = 26.10$, FeO trace, total 99.82 percent. Optical properties: $\alpha = 1.699$, $\beta = 1.712$, $\gamma = 1.734$. A manganoan hortonolite contains $MgO = 16.66$, $FeO = 44.15$, $MnO = 5.70$, $SiO_2 = 33.28$, total = 99.79 percent. Optical properties $\alpha = 1.741$, $\beta = 1.772$, $\gamma = 1.788$, specific gravity = 3.92.—M.L.L.

Frye, John C. *See* Glass, H. D. 0283

0074 **Fuller, J. Osborn.** Bedrock geology of the Garrettsville quadrangle: Ohio Div. Geol. Survey Rept. Inv. 54, 26 p., illus., geol. map, 1965.

This report, written for the layman, gives detailed descriptions of the Mississippian and Pennsylvanian units exposed and underlying the area. Erosion of the Mississippian land surface produced valleys 100 feet deep in a lowland west of the present Grand River lowland. Pennsylvanian deposits first filled these valleys then built up a sequence of delta beds. The Berea Sandstone and units of the Cuyahoga and Pottsville Groups are described in detail in the legend of the geologic map. The Sharon Conglomerate, basal unit of the Pottsville Group, makes the most spectacular scenery, is the richest economic resource, and the source of much water. Widespread glacial kames and kame terraces provide sand and gravel.—G.D.C.

Gagliano, Sherwood M. *See* Coleman, James M. 0214

0189 **Galbreath, Edwin C.** A corvid from the Miocene of Colorado: Illinois Acad. Sci. Trans., v. 57, no. 4, p. 282, 1964.

The author believes that no previous corvids from Tertiary deposits have been reported from North America. This bone fragment came from the lower part of the Pawnee Creek Formation associated with Kennesaw local fauna of upper Miocene age in Logan County. The humerus fragment showed structural differences from the humerus of individuals of several species of corvids.—M.C.

0236 **Gans, Philip.** The computer in petroleum exploration [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 127, 1964.

Garner, L. E. *See* Fisher, W. L. 0011

Garner, L. E. *See* Fisher, W. L. 0366

0149 **Garrels, Robert M.; Christ, Charles L.** Solutions, minerals, and equilibria: New York, Harper and Row, 450 p., illus., tables, 1965.

While this is essentially a new textbook from title to index, it is actually a second edition based on the earlier book, *Mineral Equilibria*, by Dr. Garrels published in 1960 in the Harper's Geoscience Series. The theme of the volume is the application of thermodynamics to natural systems of geological interest and geochemical concern. The main problem is to portray, by the simplest and most effective methods, the simultaneous chemical reactions, particularly equilibrium relations, among minerals. The original book was limited to consideration of stability relations at room temperatures and pressures near 1 atmosphere. The present volume includes chapters on complex ions, cation exchange and cation electrodes, "combination diagrams," and the effects of changing temperature and pressure on equilibria, as well as the original chapters which have been rewritten.—M.C.

0183 **Gaudette, Henri E.; Chapman, Carleton A.** Web joint pattern of the Cape Neddick gabbro complex, southwestern Maine: Illinois Acad. Sci. Trans., v. 57, no. 4, p. 203–207, illus., 1964.

Joints in the roughly circular gabbroic pluton of Cape Neddick, Maine, are radial and tangential and form a pattern resembling a spider web. Mafic dikes, though small and not numerous, form only a radial pattern. Both dikes and joints are considered to be related and appear to have formed in the solid pluton by a mild but sudden doming action. These conclusions corroborate Hussey's findings that the gabbroic pluton was emplaced as a series of explosive intrusions controlled by cone fracturing.—Authors' abstract

0295 **Gèze, Bernard.** Sur la classification des dynamismes volcaniques: Bull. Volcanol., v. 27, p. 237–257, illus., 1964.

A classification of volcanism from the dynamic point of view is suggested, in which there are four major types (each with a number of subdivisions): volcanic clouds (explosive or vulcanian type), extrusions (extrusive or dome type), flows (effusive or hawaiian type), and projections (mixed or strombolian type). Examples to illustrate each type include Mt. Pélee in Martinique, Katmai in Alaska, several volcanoes in Hawaii, and Parícutin in Mexico. The dynamic course of an eruption can be plotted on ternary diagrams with the gaseous, solid, and liquid phases as the poles.—D.B.V.

0060 **Gillain, Pierre R.** Geology of Naquiperdu Lake area, Abitibi and Mistassini territories [also French edition]: Quebec Dept. Nat. Resources Prelim. Rept. 525, 8 p., table, geol. map, 1965.

This area, 160 mi northwest of Chibougamau, is a region of low relief with ridge and valley topography. The Precambrian bedrock is characterized by an east-west trending band of metasedimentary and metavolcanic rocks in the southern part, bordered to the north and south by granitic rocks which grade into gneissic in the north. Two hills of serpentinized ultrabasic rock occur in the southeast quarter. Diabase, the youngest consolidated rock, cuts the older formations as dikes. A thick blanket of Quaternary sand and gravel covers the area. Some drumlinoid hills are elongated to the southwest parallel to the glacial striae and raised beaches are found on the north shore of the Broadback River. Only traces of mineralization including pyrite, pyrrhotite, disseminated beryl, and a rock with Cu, Ag, and Pb were noted.—M.C.

0077 **Gilvarry, J. J.** The lunar origin of tektites: Icarus, v. 4, no. 3, p. 317–318, 1965.

The purpose of the present communication is to extend the theory of a lunar hydrosphere and atmosphere (Gilvarry, 1960) to explain some of the anomalies of isotopic abundance in the tektites, which otherwise would militate against lunar origin for tektites. To interpret these anomalies it seems necessary to postulate

geochemical processes of differential solubility, that is, processes occurring in the presence of water.—G.D.C.

0283 **Glass, H. D.; Frye, John C.; Willman, H. B.** Record of Mississippi River diversion in the Morton Loess of Illinois: Illinois Acad. Sci. Trans., v. 57, no. 1, p. 24–27, illus., table, 1964.

The ancient Mississippi River in Bureau County was diverted by the advancing Shelbyville (Woodfordian) glacier; this produced a change in mineral composition of the Morton Loess, which was being deposited on the bluffs of the valley below that area. The stratigraphic position of the composition change has been identified by X-ray diffraction studies of clay minerals in the loess in the present Illinois River valley, which was an eastern loop of the Mississippi before diversion. Montmorillonite content was significantly lower in the post-diversion part of the loess deposits and in the outwash although the diversion preceded the deposition by only a short period.—M.C.

0084 **Goebel, J. B.; Wilson, A. S.** INDEX, a computer program for indexing X-ray diffraction powder patterns: Battelle-Northwest, Richland, Wash., Pacific Northwest Lab. Rept. BNWL-22, 58 p., 1965.

A computer program is presented for rapid indexing of a given X-ray diffraction powder pattern; several patterns, depending upon their complexity, can be indexed within a few minutes time. Input data required are the 2θ reflections where θ is the Bragg angle as measured by a diffractometer from powdered crystalline samples; other data supplied at the user's discretion are X-ray wavelengths, possible error value, empirical gram formula weight, and observed density. Output includes crystal system, lattice constants and standard deviations, wavelengths used, observed and calculated $\sin^2\theta$ values, difference between the latter two, an error term, and number of formula units per unit cell. The validity of the indexing is discussed, and test examples are given in an appendix.—V.S.N.

0115 **Goodman, R. E.; Moye, D. G.; VanSchalkwyk, A.; Javandel, I.** Ground water inflows during tunnel driving: Eng. Geology, v. 2, no. 1, p. 39–56, illus., table, 1965.

Large ground water inflows during tunnel driving constitute one of the most severe and baffling problems confronting the engineering geologist. In this paper an approach is offered to prediction of ground water flows through the face and sides of tunnels advanced through water-bearing zones. Mathematical approaches, the results of computer studies, and data from experiments with physical models have been combined to describe the discharge into a tunnel in a number of commonly encountered cases. These include tunnel driving under a lake or a swamp, sudden tapping of a vertical fault zone or otherwise pervious region, and advance of a tunnel through unrecharged wet ground. Curves and formulas have been prepared describing these results.—Authors' abstract

0363 **Goodwin, A. M.** Mineralized volcanic complexes in the Porcupine-Kirkland Lake-Noranda region, Canada: Econ. Geology, v. 60, no. 5, p. 955–971, illus., tables, 1965.

Archean greenstone belts contain volcanic complexes characterized by gradation from early mafic effusives to late felsic pyroclastics and sedimentary rocks. The three complexes described have areas of about 500 sq mi and stratigraphic thicknesses of 20,000 to 40,000 feet, and appear to represent volcanic extrusive-intrusive piles, with a domical structure masked to different degrees by east-west faults and folds. Some 79 percent of all base-metal and gold deposits, 87 percent of producers, are located within areas of volcanic complexes, and main occurrences are in or close to upper stratigraphic divisions. Metal concentrations are viewed as products of the later stages of igneous activity that gave rise to complexes. W.S.W.

0131 **Graf, W. H.** The preferred orientation of an elliptical cylinder in a potential flow field—A discussion [of paper by H.-U. Nissen, 1964]: Jour. Geology, v. 73, no. 3, p. 550–552, 1965.

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Proof, based on hydrodynamic theory, is given that an elliptical body such as an elongated crinoid disk will tend to set itself broadside to the direction of flow.—A.T.M.

Graham, E. R. *See* Wells, B. R. 0010

Graham, J. A. *See* Prucha, J. J. 0029

0082 **Grant, F. S.; West, G. F.** Interpretation theory in applied geophysics: New York, McGraw-Hill Book Co., 583 p., illus., tables, 1965.

This textbook has been written for university students at the intermediate level in mathematics and physics preparing for professional work in geophysics, and for professionals in geophysics and related sciences wishing to brush up on fundamentals or increase knowledge in certain fields. The aim is to build the mathematical and physical foundations for interpreting observational data in areas of applied seismology, gravimetric and magnetometric surveying, and electrical (including electromagnetic) exploration, and thus fill a gap in the literature of applied geophysics. It deals with theoretical principles rather than instruments and field practice, and no attempt is made to review or summarize current research in the field or to include extensive reference lists or bibliographies.—M.C.

Grantham, R. G. *See* Sherwood, C. B. 0107

0195 **Griffitts, Wallace R.** Recently discovered beryllium deposits near Gold Hill, Utah: Econ. Geology, v. 60, no. 6, p. 1298–1305, illus., table, 1965.

Beryllium occurs as bertrandite in quartz–adularia–calcite veins cutting a quartz-monzonite stock. These veins have abnormal contents only of Be, Fe, Mg, Ba, and Sr. Other veins in the same belt are sulfide-bearing, with high Mn, Ba, Bi, As, Ag, Pb, Cu, Zn, Ti, Mo, W. Geochemical considerations and mineralogy of deposits suggest introduction of Be as carbonate or chlorocarbonate complex.—W.S.W.

0033 **Gross, Gordon A.** Origin of Precambrian iron formations [discussion of paper by H. Lepp and S. S. Goldich, 1964]: Econ. Geology, v. 60, no. 5, p. 1063–1065, 1965.

The statistical analysis of chemical data by Lepp and Goldich (Econ. Geology, v. 59, p. 1025–1060, 1964) does not adequately support their conclusions because (1) it excludes post-Precambrian cherty iron formation and Precambrian minette types; (2) in attributing apparent uniformity to control in some areas, it ignores geologic evidence such as that suggesting contemporaneous vulcanism; (3) it does not satisfactorily demonstrate that significant replacement of calcium carbonate by silica has actually occurred; and (4) the assumption that the iron–calcium ratio of source areas is the same as that of the lithosphere is not necessarily valid.—W.S.W.

0016 **Gross, M. Grant.** The carbonate content of surface sediments from the Northeast Pacific Ocean: Northwest Sci., v. 39, no. 3, p. 85–92, illus., 1965.

Bottom topography appears to be a major factor controlling rates of deposition and the $CaCO_3$ content of the sediments deposited in much of the study area, but there are marked differences between the Northern and Southern Seamount Provinces. Modern marine sediments near the coast of Washington and Oregon generally contain less than 3 percent $CaCO_3$; more than 5 percent is found only in the Northern Seamount Province and the western part of Cascadia Basin. This is probably caused by the greater rate of deposition of low-carbonate sediments than calcareous remains of marine organisms; there is no indication that solution of carbonate controls the amount of $CaCO_3$ in sediments deposited at depths less than 3,600 meters.—G.D.C.

0005 **Gulf Coast Assoc. Geol. Societies; Corpus Christi Geol. Society; Texas University.** Depositional environments, south-central Texas coast—Gulf Coast Assoc. Geol. Socs., Annual meeting, 1964, field trip guidebook: Austin, Tex., Gulf Coast Assoc. Geol. Socs., 170 p., illus., tables, 1964.

The purpose of this field trip was to show the complexity and rapidity of change of shallow-water depositional environments, and, therefore, facies tracts at each of the localities examined are emphasized. The area visited includes Baffin Bay, Corpus Christi Bay, Aransas Bay, and the lagoons and barrier reefs between them. Contributions to a section on the study of sediments and fauna are cited individually, as well as a discussion of one of the stops.—G.D.C.

0256 **Hacquebard, Peter A.; Cameron, Alexander R.; Donaldson, J. Roger.** Die Ablagerungsbedingungen des Flözes Harbour im Sydney-Kohlengebiet von Neuschottland (Kanada) [with English and French abs.], *in* Paläobotanische, kohlenpetrographische und geochemische Beiträge zur Stratigraphie und Kohlengenese—Symposium: Fortsch. Geologie Rheinland u. Westfalen, v. 12, p. 331-356, illus., 1964.

A study of sedimentation, coal petrology and palynology in the Sydney coal district of Nova Scotia has shown that deposition of peat in the main seam migrated outward from the center of the basin. Two different phases of accumulation are represented by the bright lower part and the dull upper part of the seam; bright microlithotypes are higher in *Lycospora* and dull types in *Punctatosporites*. In one interval of the seam four environmental types can be traced laterally from fluviatile to forested bog, to open moor, and lacustrine. *Torispora* in one particular dull band are related to its "dry" origin, the density varying with proximity of source and medium of preservation.—G.D.C.

0025 **Hamblin, W. K.** Basement control of Keweenawan and Cambrian sedimentation in Lake Superior region: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 950-958, 1965.

In the Lake Superior region, dispersal patterns of Keweenawan, Jacobsville-Bayfield, and Cambrian sediments based on paleo-current data indicate the configuration of the Keweenawan basin during sedimentation. Structural trends in the basement complex are essentially parallel with (1) form lines of the basin, (2) isopach and structure contours of Keweenawan rocks, (3) post-Keweenawan structural features, and (4) the present topographic basin of Lake Superior. This suggests that, since Huronian time, resurgent tectonic activity has controlled the development of the Keweenawan basin, sediment dispersal patterns, and post Keweenawan structures.—B.H.K.

Hanks, R. J. *See* Bowers, S. A. 0006

Hanna, G. Dallas. *See* Brigger, A. L. 0257

Harbaugh, John W. *See* Merriam, Daniel F. 0152

Harding, Samuel T. *See* Algermissen, S. T. 0344

0100 **Harksen, J. C.** Geology of the Sharps Corner quadrangle, South Dakota: Vermillion, S. Dak., South Dakota Geol. Survey, scale 1:62,500, section, text, 1965.

The Sharps Corner quadrangle is entirely underlain by Tertiary bedrock sediments; from oldest to youngest, they are the White River Group, Arikaree Group, Rosebud Formation, and Ogallala Group. These strata are partially covered by unconsolidated Quaternary deposits. Of the many potential economic deposits in the quadrangle, only the sand, gravel, and water have been utilized. Potential deposits of volcanic ash, sandstone, and limestone are present but have not been quarried.—M.C.M.

0071 **Harriss, Robert C.** Trace element distribution in molluscan skeletal material—[Pt.] 1, Magnesium, iron, manganese, and strontium: Bull. Marine Sci., v. 15, no. 2, p. 265-273, illus., 1965.

A compilation and analysis of existing data on the magnesium, iron, manganese and strontium concentrations in molluscan skeletal material indicates that mineralogy is a dominant controlling factor in trace-element distribution only in the case of magnesium. It is suggested that in the case of iron, manganese, and

strontium crystal growth kinetics and/or metabolic processes must be considered as possible primary controls with mineralogy, temperature and salinity as secondary controls.—Author's abstract

0162 **Hart, S. R.; Steinhart, J. S.** Terrestrial heat flow—Measurement in lake bottoms: Science, v. 149, no. 3691, p. 1499–1501, illus., table, 1965.

Thermal stability in bottoms of deep lakes permit measurement of meaningful values for terrestrial heat flow. Those made agree well with those from a deep mine.—F.W.C.

0243 **Hase, D. H.** Geologic interpretation of magnetic map, Washington County, Iowa: Iowa Acad. Sci. Proc. 1964, v. 71, p. 284–292, illus., 1965.

In 1963, ground measurements of the vertical component of the Earth's magnetic field were made in Washington County, Iowa. The magnetic variations are attributed to differences in the lithology and configuration of the Precambrian crystalline basement complex about which no direct geologic information is available. Although a unique interpretation of the magnetic data is impossible owing to the limited geologic control, it is proposed that the basement complex is at a depth of 2,600 to 5,000 feet, may be cut by a northeasterly trending fault occurring near the city of Washington, and exhibits topographic relief which controls the formation of domes and basins in the overlying Paleozoic sedimentary rocks. If the proposed interpretation is valid, it should be possible to locate Paleozoic structures in adjacent counties by magnetic mapping.—Author's abstract

0102 **Haught, Oscar L.** Map of Barbour and Upshur Counties showing oil and gas fields, structural contours on top of Greenbrier Limestone: Morgantown, West Virginia Geol. and Econ. Survey, scale 1:62,500, 1965.

Hayatsu, Ryoichi. *See* Studier, M. H. 0163

0235 **Haye, Edward F.** Geologist, help your geophysicist [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 125, 1964.

0003 **Hayes, Miles O.** Grain size modes in Padre Island sands, *in* Depositional environments, south-central Texas coast—Gulf Coast Assoc. Geol. Socs., Ann. Mtg., 1964, Field Trip Guidebook: Austin, Tex., Gulf Coast Assoc. Geol. Socs., p. 121–126, illus., table, 1964.

Recent studies indicate that sedimentary environments can be distinguished on the basis of statistical grain-size parameters, skewness being very useful in the case of beach and dune sediments. In this study on Padre Island, the parameters from 57 dune and 16 beach samples show no differentiation on this basis. The discrepancy is thought to be due to two grain-size modes, both within the fine sand range, in central Padre Island, the "coarse" mode being more prevalent southward, and the "fine" mode northward. The source materials, from separate areas in this case, appear to have a strong influence on size distribution, and where polymodality is pronounced may obliterate environmental influence.—G.D.C.

0004 **Hayes, Miles O.** Previous geological studies, *in* Depositional environments, south-central Texas coast—Gulf Coast Assoc. Geol. Socs., Ann. Mtg., 1964, Field Trip Guidebook: Austin, Tex., Gulf Coast Assoc. Geol. Socs., p. 158–170, table, 1964.

Numerous references pertaining to the different nearshore environmental complexes of the south-central Texas coast are tabulated; those recommended to give the quickest and most comprehensive review of the geological aspects are marked with asterisks. The coastal area is divided into inner neritic zone, barrier island complex, wind-tidal flats, lagoon-bay complex, and aeolian sand plain.—G.D.C.

0223 **Hayes, Miles O.; Scott, Alan J.** Environmental complexes south Texas coast [summary]: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 237–240, 1964.

The most important nearshore environmental complexes on the south Texas coast are the inner shelf, barrier island complex, lagoon-bay complex, deltaic plain and

aeolian sand plain. Each of these is a facies tract subject to the effect of many climatic and hydrologic variables. The general climate is semi-arid; the hydrologic setting is wave-dominated. Other variables, affected by climate are salinity, amount of available terrigenous material, and vegetative cover. The definition of diagnostic features of deposits in the complexes is outlined. The importance of catastrophic events as modifying agents is illustrated by major effects of hurricane *Carla*. G.D.C.

0337 **Hayes, Miles O.** Summary of geological effects of hurricanes *Carla*, 1961 and *Cindy*, 1963 on the South Texas coast, *in* Depositional environments, south-central Texas coast—Gulf Coast Assoc. Geol. Socs., Ann. Mtg., 1964, Field Trip Guidebook: Austin, Tex., Gulf Coast Assoc. Geol. Socs., p. 127–136, illus., 1964.

In this area hurricanes are important geological agents. As *Carla* moved landward various bottom materials from depths as great as 50–80 feet were transported to the beach and scattered over the barrier complex and wind-tidal flats. After the storm, strong density currents spilled out of numerous channels cut through the barrier island by the hurricane, and spread a sand layer over the formerly homogeneous mud bottom at depths of 48–60 feet, and graded deposits farther out on the shelf. Effects on each of the shore features is described briefly. Hurricane *Cindy* deposited a swash bar, averaging 50 feet wide, across the contact between the old *Carla* beach and the post-*Carla* prebeach, with large ripples perpendicular to the beach in the runnel behind the bar.—G.D.C.

Heezen, Bruce C. *See* Fox, Paul Jeffrey. 0166

0041 **Heinrich, E. William.** Further information on the geology of chromian muscovites: Am. Mineralogist, v. 50, nos. 5–6, p. 758–762, 1965.

Most chromian muscovite probably owes its origin to regional metamorphism rather than to metasomatic or hydrothermal processes. Widely scattered occurrences of chrome muscovite from the Precambrian of the Rocky Mountains area and from other areas in the United States and Africa are cited in support of this hypothesis. In the opinion of the author, the papers by Leo et al. (1965), Geijer (1963), and Whitmore et al. (1946) overly emphasize the role of hydrothermal processes.—R.S.F.

0072 **Heinrich, E. Wm.** Microscopic identification of minerals: New York, McGraw-Hill Book Co., 414 p., illus., tables, 1965.

This textbook has evolved from lectures and laboratory sections for a one semester course in principles of optical crystallography. Where other texts in the field emphasize properties of minerals in thin sections, this book is concerned primarily with their characteristics as immersed microfragments. It also attempts to present the best charts available relating the variation of optical properties in a series or group to compositional variation. It thus serves as an elementary introduction to optical microscopy in practice, as well as a companion volume to modern texts dealing with the theory of optical microscopy.—M.C.

Heylmun, Edgar B. *See* Mayhew, E. Jay. 0093

Hill, E. L. *See* Ruhe, R. V. 0277

Hinze, W. J. *See* Rudman, A. J. 0024

Ho, Clara. *See* Kelley, Wilbourne A., 3d. 0291

0087 **Hobbs, P. V.** The effect of time on the physical properties of deposited snow: Jour. Geophys. Research, v. 70, no. 16, p. 3903–3907, illus., 1965.

The observed changes in a number of the physical properties of snow with time are explained by the growth of ice necks between the particles. The necks grow as a result of the diffusion of water vapor to these regions, and the diffusion is brought about by the low vapor pressures existing in the neighborhood of the necks. It is shown that experimental results for the variation with time of compressive

strength, work of disaggregation, hardness, and Young's modulus of deposited snow can be explained quantitatively in terms of this theory.—Author's abstract

0169 **Hodge, Dennis S.; Worl, Ronald G.** Multiple metamorphic episodes in Precambrian rocks near South Pass City, Wyoming: Wyoming Univ. Contr. Geology, v. 4, no. 2, p. 51–57, illus., 1965.

Laboratory and field studies were made on Precambrian igneous and metamorphic rocks in the southwestern Wind River Mountains. A granite stock and related pegmatite and quartz veins have been emplaced in pelitic and quartzo-feldspathic metasedimentary rocks, which are mostly quartz-plagioclase-hornblende and quartz-biotite-plagioclase porphyroblastic schists belonging to the almandine-amphibolite regional metamorphic facies. A contact aureole belonging to the hornblende-hornfels contact metamorphic facies surrounds the granite stock and the greenschist facies mineral assemblages were produced by recrystallization of these metamorphics and the granitic rocks during retrogressive metamorphism. At least three phases of metamorphic adjustment have occurred—almandine-amphibolite regional metamorphism, contact metamorphism, and a retrogressive period of metamorphism.—M.C.

0026 **Hodgson, R. A.** Genetic and geometric relations between structures in basement and overlying sedimentary rocks with examples from Colorado Plateau and Wyoming: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 935–949, illus., 1965.

Areal pattern of deformation in the Colorado Plateau and central Wyoming were well established before the end of Precambrian and are recognizable today in all orders of structures in both basement and sediments. These patterns appear to be reflected and refracted upward through the sediments in response to crustal fracturing and differential vertical movement. Jointing is widespread and regular but other deformation is confined to narrow linear zones which generally follow joint directions and with sense of displacement primarily vertical. Structural lineaments mark the boundaries of large crustal blocks. Forces producing these structures originate deep in the crust.—S.P.S.

Hoffman, J. F. *See* DeLuca, F. A. 0150

0231 **Holcomb, C. W.** Frio formation of Southern Texas. Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 23–33, illus., 1964.

Age and stratigraphic position of the Frio formation in South Texas are discussed both as to surface and subsurface position, and a division of the Frio formation into Upper and Lower Frio is proposed. The enclosing Anahuac and Vicksburg sediments are also described and regional extent discussed. Depositional environments and facies within the Frio formation are discussed with emphasis on regional relationships. Generalized regional structural contour maps, diagrammatic cross-sections, and a faunal updip limit map are included. An oil and gas map shows distribution of production within the Upper Frio.—Author's abstract

0190 **Holland, Heinrich D.** Some applications of thermochemical data to problems of ore deposits—[Pt.] 2, Mineral assemblages and the composition of ore forming fluids: Econ. Geology, v. 60, no. 6, p. 1101–1166, illus., tables, 1965.

New and revised thermochemical data are used in the construction of fugacity diagrams for various elements found in hydrothermal ore deposits at temperatures of 100°C, 250°C, 400°C, and 600°C. The fields considered cover the following ranges of fugacities: CO_2, 10^{-2}–10^{2}; O_2, 10^{-60}–10^{-40} at 100°C to 10^{-24}–10^{-10} at 600°C; S_2, 10^{-24}–10^{-8} at 100°C to 10^{-14}–10^{+2} at 60°C. For each temperature, separate sets of diagrams show, respectively, the stability fields of appropriate minerals and the fugacities of expectable gas phases. Applying these diagrams to the evolution of hydrothermal fluids on cooling suggests a combination of chemical equilibria within the fluids and pH- controlling wall-rock reactions determine mineralogy.—W.S.W.

0251 **Holman, J. Alan.** A late Pleistocene herpetofauna from Missouri: Illinois Acad. Sci. Trans., v. 58, no. 3, p. 190–194, 1965.

A cave called Crankshaft Pit, 20 mi southwest of St. Louis, developed in the Joachim Formation of Ordovician age, is the site of a large number of Pleistocene amphibian and reptile bones, including 1,894 vertebrae of at least 10 species of snakes, and a few salamander, frog, and legless lizard remains. The bone bed is in a filled crevice in the floor of the horizontal tunnel. The unstratified matrix from which the fossils came may represent a mudflow into the crevice. A concentrate of the washed matrix contained the remains of the extinct armadillo, *Dasypus bellus*, and tapir bones, thus indicating a Pleistocene age. All the amphibian and reptilian genera and species present represent forms that are living today.—M.C.

0109 **Holton, Charlotte.** (compiler) Bibliography of vertebrate paleontology and related subjects, 1962–1963: Soc. Vertebrate Paleontology Bibliography, no. 18, 74 p., 1964.

This bibliography is compiled from periodicals received by the Library of the American Museum of Natural History in New York City.—M.C.M.

0259 **Holton, Charlotte.** (compiler) Bibliography of vertebrate paleontology and related subjects, 1963–1964: Soc. Vertebrate Paleontology Bibliography, no. 19, 56 p., 1965.

This bibliography is compiled from periodicals received by the Library of the American Museum of Natural History in New York City.—M.C.M.

0043 **Honea, R. M.** Reply to discussion (1965) of "Empressite and stuetzite redefined," by R. M. Honea (1964): Am. Mineralogist, v. 50, nos. 5–6, p. 802–804, 1965.

In a further discussion of natural and synthetic Ag–Au tellurides, the use of the above mineral names is defended.—E.H.R.

0027 **Hoppin, R. A.; Palmquist, J. C.** Basement influence on later deformation—The problem, techniques of investigation, and examples from Bighorn Mountains, Wyoming: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 993–1003, illus., 1965.

Fracture patterns, revealed by statistical plots, are markedly different in basement rocks when compared with those in the adjacent sedimentary rock cover. It is suggested that the 400–1,000 feet of basal incompetent Paleozoic rocks acted as an insulator with the result that the higher competent cover rocks acted independently of the basement. Basement foliation is largely discordant with the over-all trend of the range and cannot be correlated with any single fracture direction. The structure of the range formed in response to post-Precambrian regional stresses.—A.E.R.

0221 **Horne, Jerry D.** A stratigraphic revision within the Jackson Group in south central Texas: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 277–283, illus., table, 1964.

During the mapping of the surface outcrop of some of the upper Jackson beds in southeastern Atascosa County, it was discovered that the sandstone bed commonly mapped as the Stones Switch Member of the Whitsett Formation did not correlate with the type locality established by Ellisor (1933). The type locality was found to be laterally discontinuous and stratigraphically lower than the sandstone bed mapped as Stones Switch in Karnes County. A new name, the Lipan Hills sandstone, is applied to the upper bed in this paper, and a type locality established. The less continuous and stratigraphically lower Stones Switch sandstone is relegated to the status of a lentil within the Dilworth Member of the McElroy Formation as defined by Eargle (1959).—G.D.C.

0067 **Hyde, Luther W.** Principal aquifers in Florida: Florida Board Conserv. Div. Geology Map Ser., no. 16, scale about 1 in to 30 mi, text, 1965.

The thick Tertiary limestones of the Floridan aquifer underlie the entire State and supply ground water to all but southernmost and westernmost Florida. The

nonartesian Biscayne aquifer, composed of rocks ranging in age from late Miocene through Pleistocene, underlies an area of about 3,000 sq mi in Dade, Broward, and southern Palm Beach Counties. In extreme western Florida the nonartesian sand-and-gravel aquifer is composed of sediments ranging from Miocene to Pleistocene. A shallow nonartesian aquifer, present over much of the State, is used mostly in rural areas.—M.C.M.

Iglehart, Charles F. *See* Forgotson, James M., Jr. 0232

Ingram, Blanche. *See* Milton, Charles. 0356

0240 **Iowa Academy of Science.** Donald T[homas] Davidson, 1919–1963: Iowa Acad. Sci. Proc. 1964, v. 71, p. 40–41, 1965.

0241 **Iowa Academy of Science.** Robert E[ugene] Rundle, 1915–1963: Iowa Acad. Sci. Proc. 1964, v. 71, p. 44–45, 1965.

Ito, Jun. *See* Frondel, Clifford. 0050

Jackson, M. L. *See* Kiely, P. V. 0165

Jacobson, Robert A. *See* Lawton, Stephen L. 0104

Javandel, I. *See* Goodman, R. E. 0115

0051 **Jenkins, D. Graham.** Planktonic foraminifera and Tertiary intercontinental correlations: Micropaleontology, v. 11, no. 3, p. 265–277, illus., 1965.

Some hypotheses involved when the time-stratigraphic ranges of planktonic Foraminifera are used for intercontinental correlation of Tertiary marine rocks are examined. An order of reliability as time indices is suggested for the various kinds of events observed in the Tertiary history of this group. Assumptions regarding their origin and homoeomorphy and dispersal of new species are discussed. Maps illustrating the probable distribution of eight short-ranging Tertiary species and subspecies in latitudinal belts is given. An active exchange of topotype material is advocated.—G.D.C.

0057 **Jerome, S. E.; Campbell, Douglas D.; Wright, Jack S.; Vitz, Howard E.** Geology and ore deposits of the Sacramento (High Rolls) mining district, Otero County, New Mexico: New Mexico Bur. Mines and Mineral Resources Bull. 86, 30 p., illus., tables, geol. maps, 1965.

In this mining district Precambrian rocks are unconformably overlain by the Abo Formation of Permian age, over which lies conformably(?) the Yeso Formation, also Permian. The east dipping monoclinal structure is cut by moderate faults. The Abo Formation contains small, irregular deposits of copper and lead minerals in arkose beds sandwiched between red shales. It is suggested that these ores are "semisyngenetic" in origin, later oxidized and the metals reconcentrated by the action of ground water. The source of the metals has not been established, and there appear to be no related ore deposits in adjacent formations.—G.D.C.

Jonas, Edward C. *See* Roberson, Herman E. 0357

0226 **Jones, Franklin C.** The lower Wilcox trend, DeWitt County, Texas: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 203–207, illus., 1964.

Exploration for lower Wilcox reservoirs has steadily increased since 1957. Fifteen fields have been discovered in the county and an appraisal can now be made of the trend and its future. An exploration case history of Cuero Field, one of the first discoveries along the trend, demonstrates the problems encountered in exploration and suggests criteria that will assist in planning future programs in the area.—Author's abstract

0063 **Juan, V. C.** Earth's crust and mantle: Geol. Soc. China Proc. 1964, no. 8, p. 3–9, 1965.

Fresh evidence has changed man's views on the structure of the Earth's interior. Current ideas on the composition of the mantle are reviewed including those of several North American scientists. Opinions about the origin of basaltic magma differ widely: on the one hand deep in the mantle, on the other by local anatexis. Recent seismic studies in the western United States indicate several velocity layers, which would lead to new interpretation of the structure and composition of different tectonic regions.—G.D.C.

Kaesler, Roger L. *See* Benson, Richard H. 0054

0160 **Kahil, Alain A.** Ground-water survey of the Rock Lake area, Towner County, North Dakota: North Dakota Water Conserv. Comm. North Dakota Ground-Water Study 63, 32 p., illus., tables, 1965.

Private wells supply the villagers of Rock Lake with water, generally from interbedded sand in the Pierre Shale of Late Cretaceous age. The impervious Pierre Shale, of unknown depth, is not considered a good aquifer, although outside the area where it is weathered and jointed it is a larger source. Its irregular surface is buried by glacial drift, within which are sand and gravel aquifers up to 98 feet thick, the most significant of which lie directly on the bedrock; some of these aquifers are recharged by the lake. Glacial drift water is superior in quality, except for hardness and iron concentration. Chemical analyses and test-hole logs are given.—G.D.C.

Kapp, Donald O. *See* Smith, Jerry G. 0185

0339 **Kaufman, Aaron; Broecker, Wallace S.** Comparison of Th^{230} and C^{14} ages for carbonate materials from Lakes Lahontan and Bonneville: Jour. Geophys. Research, v. 70, no. 16, p. 4039-4054, illus., tables, 1965.

The reliability of the radiocarbon and uranium series inequilibrium absolute-dating methods were evaluated on the basis of analyses of 50 samples of various Pleistocene materials from Lakes Bonneville and Lahontan for C-14, U-238, U-234, Th-232, Th-230, and Ra-226. In samples in which Ra-226 is at equilibrium with Th-230 and the Th-232 concentration is not unusually large, agreement between the two methods is satisfactory. When there is disagreement the lower age appears to be in error. Th-230 offers the possibility of extending the absolute chronology of these lakes back to 200,000 yr ago. Independent age estimates based on the appearance of excess U-234 are clearly invalid.—D.B.V.

0194 **Kays, M. Allan.** Petrographic and modal relations, Sanford Hill titaniferous magnetite deposit: Econ. Geology, v. 60, no. 6, p. 1261-1297, illus., tables, 1965.

Textural observations (reaction rims, relation to granulation) and petrographic calculations based on a large number of modal analyses suggest that the gabbroic rocks of the area may be products of reaction, during Grenville metamorphism, between pre-existing (pre-Grenville) anorthosite and ore, rather than intermediate products of a magmatic differentiation series. The ultimate origin of the ore is not clear.—W.S.W.

0108 **Keeler, C. M.** Relationship between climate, ablation, and run-off on the Sverdrup Glacier, 1963, Devon Island, N.W.T.: Arctic Inst. North America Research Paper 27, 85 p., illus., tables, 1964.

In this final report of the Devon Island Expedition, an attempt was made to account for short term disagreements between calculated amounts of ablation measured by different methods. Errors may be as great as 50 percent, but it is still possible to correlate them with climatic conditions. Physical changes in the ice structure resulting from heat flow, radiation, turbulent flux, cryoconite holes, and crystal behavior are noted.—G.D.C.

Keen, M. J. *See* Berger, J. 0023

0276 **Keller, George H.** Deep-sea nuclear sediment density probe: Deep-Sea Research, v. 12, no. 3, p. 373-376, illus., 1965.

The instrument, using scattered gamma rays to measure *in situ* sediment density profiles, is a self-contained probe 7.8 m long with its own power supply and data recording system. A radioactive source and a detector are located near the bottom. On penetration of the sea floor, the nose of the probe is forced up into the barrel and, when a magnetic contact is made, the measuring phase starts. On completion of penetration, the traveling detector and source are raised within the barrel a total distance of 3.7 m with stops every 0.6 m for a 10-sec count period; gamma rays are counted by binary scalers and recorded on 8 mm film. In soft bay sediments in Florida probe values were more representative than cores. In deep water the probe measures 60 sites in the time needed to pick up 4 or 5 cores.—M.C.

0125 **Kelley, Vincent C.** Relationships of rock fractures: Jour. Geology, v. 73, no. 4, p. 668–669, illus., 1965.

A gradational relation among cleavage, joints, faults, and small irregular breaks is shown in a tetrahedral diagram and discussed in the brief text.—B.V.L.

0291 **Kelley, Wilbourne A., 3d; Ho, Clara.** Clay mineralogy of a gumbotil: Iowa Acad. Sci. Proc. 1964, v. 71, p. 342–349, illus., table, 1965.

Investigation of the clay minerals in a gumbotil associated with the Mahaska soil series in Keokuk County, Iowa, indicates that the principal clay mineral is a dioctahedral calcium montmorillonite. Other clay minerals present in this gumbotil are kaolinite and mica, although they are in much smaller percentages. The investigation also pointed out difficulties involved in analyzing this type of soil by standard X-ray procedures and the complications introduced in the analysis of soil samples with high iron content utilizing standard accepted diffraction techniques.—Authors' abstract

0330 **Keplinger, John L.** Riceville Field, Vermilion Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 28–28d, illus., 1964.

0306 **Kepner, Thomas.** Cameron Meadows Field, Cameron Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 3–3d, illus., 1964.

0028 **Kerr, J. W.; Christie, R. L.** Tectonic history of Boothia uplift and Cornwallis fold belt, Arctic Canada: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 905–926, 1965.

Crystalline rocks in the Boothia Peninsula, District of Franklin, are a north-trending extension of the Precambrian shield and form the elongate core of the Boothia uplift. Proterozoic to Upper Devonian sediments of the Cornwallis fold belt flank this uplift and overlie it to the north; north-trending structures in the fold belt are the result of movements of the Boothia uplift. Erosion surfaces and unconformities indicate uplifts occurred in Precambrian, pre-Middle Cambrian, mid-Early Devonian, late Early to early Middle Devonian, mid-Late Devonian, and Pennsylvanian to Early Permian. A comprehensive bibliography on Arctic Canada is included.—B.H.K.

0280 **Kerr, Paul F.; Langer, Arthur M.** Mineralogical features of Mojave Desert playa crusts, [Chap.] 2 *in* Geology, mineralogy, and hydrology of U.S. playas: U.S. Air Force Cambridge Research Labs., Environmental Research Paper 96 (AFCRL-65-266), p. 31–72, illus., tables, 1965.

Six surface types of playa crusts are found in the Mojave Desert, California. The constituents are essentially clay minerals and other sheet silicates, granular minerals (oxides and silicates), and saline components. Physical properties of crusts depend largely on relative proportions of mineral constituents and presence or absence of moisture. Hard, dry, compact, impermeable crusts have Knoop indentations values suggesting high bearing strength and contain over 50 percent clay minerals, high carbonate content, and low soluble saline content. Puffy surfaces have less than 35 percent clay and a low carbonate and high saline content, as well as considerable granular material, moderate permeability, and are strongly affected by rains. An

intermediate type has 35 to 49 percent clay and transitional properties but resemble clay-surface playas. Other types are salt pavement, calcareous, and permanently wet crusts.—M.C

0174 **Kesling, Robert V.** Primibrachials and arms of *Alloprosallocrinus conicus* Casseday and Lyon, a Lower Mississippian camerate crinoid: Michigan Univ. Mus. Paleontology Contr., v. 19, no. 15, p. 257–263, illus., 1965.

Many specimens of *Alloprosallocrinus conicus* Casseday and Lyon contain rays with only one, or essentially one, *PBr*, as stressed by the original authors (1862), Wachsmuth and Springer (1897), and others. One specimen reported by Van Sant and Lane (1964) contains rays with two *PBrBr*, said to be abnormal. All four specimens [from Kentucky and Tennessee] of this species in the Museum of Paleontology of The University of Michigan have two *PBrBr* per ray, suggesting that such development is not unusual. Three of the Michigan specimens have 14 arms each, although the greatest number previously reported is 12. Variations in *PBrBr* in *A. conicus* is reminiscent of similar variations recently reported in species of *Dolatocrinus*.—Author's abstract

0165 **Kiely, P. V.; Jackson, M. L.** Quartz, feldspar, and mica determination for soils by sodium pyrosulfate fusion: Soil Sci. Soc. America Proc., v. 29, no. 2, p. 159–163, illus., tables, 1965.

The proposed sodium pyrosulfate fusion method has proved applicable for mineralogic analyses of sand, silt, and coarse clay fractions of a wide variety of soils containing natural-sized feldspars and quartz. Micas and layered silicates are selectively dissolved by it, and the quartz and feldspar concentrated for simpler identification by X-ray diffraction, quantitative determination by gravimetry, and chemical allocation of the Na, K, and Ca to the respective feldspars. Minerals of a 500 to 50 μ soil fraction determined by the method amount to 99 percent. In silt fractions with soluble minerals, the percentage is lower.—M.C.

0318 **Kimmey, Bill W.** Johnsons Bayou field, Cameron Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 16–16c, illus., 1964.

Kinoshita, W. T. *See* Davis, W. E. 0168

Kirby, James P. *See* Wilson, Charles W., Jr. 0209

Kitzinger, E. *See* Bergstein, A. 0048

0110 **Klaer, P.; Matthée, H.** Uranerzbergbau in den Vereinigten Staaten—Vier Grubenfahrten im Big Indian District des Colorado-Utah-Gebietes: Zeitschr. Erzbergbau u. Metallhüttenwesen, v. 18, no. 6, p. 278–284, illus., tables, 1965.

A very brief review of the geology of the uranium belt in Colorado and Utah is included in this report on mining engineering in the Big Indian district.—G.D.C.

Klassen, R. W. *See* Clayton, Lee. 0124

0271 **Klassen-Neklyudova, M. V.** Mechanical twinning of crystals [translated from Russian by J. E. S. Bradley]: New York, Consultants Bureau, 213 p., illus., tables, 1964.

The original Russian text of this volume, published in Moscow in 1960, has been revised and expanded for the English edition. The monograph is not limited to lattice reorientation in response to mechanical stress, but deals with many related effects including the formation of reoriented regions in response to high temperatures, as in martensite transformations and recrystallization twins, electrical fields, as in ferroelectric domains, and magnetic fields, as in magnetic domains. It includes experimental data on mechanical twinning with discussions of twinning with and without change of form; effects related to mechanical twinning such as martensite phase transitions, recrystallization twins, and lattice reorientation in

inhomogeneous deformation; the macroscopic and microscopic theory of twinning; and applications of selective etching to twinning studies.—M.C.

0249 **Klutts, Joe R.** Bear Head Creek Field, Beauregard Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 1–1c, illus., 1964.

0299 **Knox, Joseph B.; Short, Nicholas M.** A diagnostic model using ashfall data to determine eruption characteristic and atmospheric conditions during a major volcanic event: Bull. Volcanol., v. 27, p. 5–24, illus., 1964.

A model is developed for estimating location of a volcano relative to simple points in an associated ashfall, cloud height during the eruption, and mean wind velocity during ash deposition. The ash deposit must cover a large area and have an elongate axis. The model appears to be applicable to both recent and unobserved past ashfalls, provided adequate and representative ash samples are available. The model is applied to the Kekla, Iceland, eruption of 1947, the only one for which suitable particle size analyses are available, but it is believed that the model will work effectively on elongate deposits extending at least 50 mi beyond the vent.—D.B.V.

Konizeski, R. L. *See* McMurtrey, R. G. 0285

0089 **Kottlowski, Frank E.** Measuring stratigraphic sections: New York, Holt, Rinehart and Winston, 253 p., illus., tables, 1965.

This field manual describes comprehensively the field techniques for measuring stratigraphic sections. The chief purposes for measuring sections and their applications in stratigraphy, subsurface correlation, areal and structural geology, and sampling problems are explained; and site selection is discussed of a complete stratigraphic section, exposed in a small area and not modified by faults or structural complications, which involves finding the best combination of rock exposures, topography, and geologic structure to satisfy the requirements of accessibility and available time, funds, equipment, and personnel. Descriptions are given of the techniques for establishing control, including Jacob-staff, transit, and Brunton compass and tape measurements, the types of measurements of horizontal, vertical, and inclined layers, possible errors in measurement and their correction, and preparation of final reports.—M.C.

0056 **Kremp, G. O. W.; Spackman, W.; Ames, H. T.** (editors) Catalog of fossil spores and pollen—Cumulative index, V. 11–20: University Park, Pennsylvania State Univ., Palynolog. Lab., Dept. Geology, Coll. Mineral Industries, 144 p., 1965.

Entries in this index are arranged alphabetically under four major sections: (1) comprehensive index to taxa of all ranks; (2) stratigraphic locations and geographic terms; (3) list of authors and other individuals mentioned in the text of the Catalog; and (4) list of the published sources of specific descriptions in volumes 1 through 20. In section 2, rock units of a rank lower than formation generally have been omitted, and large countries have been referenced by lesser (but not minor) political divisions or geographic areas.—G.D.C.

Kupsch, W. O. *See* Clayton, Lee. 0124

0247 **Lafayette Geological Society.** Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., [156] p., illus., 1964.

This publication is intended to be a guide for those who are unfamiliar with the area or with a particular field. Thirty-two fields were selected to show one or more examples of salt and fault-controlled structures, shallow and deep production, and production from various ages of sediments. Thirty of the fields presented here have not been published before. Each field study has been prepared by a geologist who is expert in the area.—Foreword

0293 **Lafayette Geological Society.** South Lake Charles and Coulee Hippolyte Fields, Calcasieu Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 29–29e, illus., 1964.

0319 **Lafayette Geological Society.** Kaplan Field, Vermilion Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 17–17b, illus., 1964.

0329 **Lafayette Geological Society.** Patterson Field, St. Mary Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 27–27e, illus., 1964.

0333 **Lafayette Geological Society.** Tepetate Field, Acadia Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 32–32e, illus., 1964.

Laird, Wilson M. *See* Clayton, Lee. 0124

0080 **Landisman, Mark; Sato, Yasuo; Nafe, John E.** Free vibrations of the Earth and the properties of its deep interior regions—Pt. 1, Density: Royal Astron. Soc. Geophys. Jour., v. 9, no. 5, p. 439–502, illus., tables, 1965.

Density in the Earth is predicted by a new method based on periods of torsional and spheroidal free oscillations, P and S traveltimes, total mass, and moment of inertia derived from the satellite value of flattening. Densities predicted for one model are close to the Bullen A′ distribution down to about 500 km, slightly lower to 1,100 km, then slightly higher to 1,800 km, and essentially constant between 1,600 and 2,800 km. The value near the base of the mantle is about 10 percent lower than in Bullen's A′, outer core densities are about 2 percent higher. Central density is 15.42 g per cm^3. Another model gives outer core densities 4 percent higher than those for Bullen's A′ and a central density of 12.63 g per cm^3.—D.B.V.

0294 **Landry, Paul R.** Clear Creek Field, Allen and Beauregard Parishes, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 5–5d, illus., 1964.

Langer, Arthur M. *See* Kerr, Paul F. 0280

0304 **LaSalle, Pierre.** Radiocarbon date from the Lake St. John area, Quebec: Science, v. 149, no. 3686, p. 860–862, illus., 1965.

A radiocarbon age of 8680±140 yr found for fossil marine shells in the Lake St. John area, Quebec, shows that marine submergence there apparently preceded the "Tyrrell Sea" in southeastern Hudson Bay, but followed the Champlain Sea episode in the St. Lawrence Lowlands.—Author's abstract

Lawson, D. C. *See* Chelini, J. M. 0265

0104 **Lawton, Stephen L.; Jacobson, Robert A.** The reduced cell and its crystallographic applications: Iowa State Univ. Sci. and Technology, Ames, Lab. Rept. IS-1141, 204 p., illus., tables, 1965.

The reduced cell, that is, the cell whose axes are the three shortest non-coplanar translations in the lattice and form only one per lattice, is described along with its applications to structural crystallography. Typical applications are its use as the standard choice of the unit cell in a triclinic lattice and the use of its scalars in identifying in a lattice the cell of the highest symmetry. An explanation is included of two FORTRAN computer programs that can be used to locate the reduced cell in a lattice, to calculate its parameters, and to derive the matrix for the transformation of the original cell to the reduced cell.—M.C.

0127 **LeComte, P.** Creep in rock salt: Jour. Geology, v. 73, no. 3, p. 469–484, illus., tables, 1965.

Creep tests were made on polycrystalline specimens of various grain size and on one single crystal of rock salt at room temperature to 300°C, confining pressure to 1 kb, stress difference to 138 bars. Increase in temperature or stress difference increases creep rate considerably; increase in confining pressure or grain size decreases creep rate moderately. The activation energy for creep ranges from 125,000

cal/mol at 29°C to 30,000 cal/mol at 300°C, and $\epsilon = A + Bt^n$, where ϵ is the deformation at time t after application of load, and A, B, and n are constants with $0 < n < 1$. A creep controlling mechanism based on the intersection of moving dislocations and on dynamic recovery is considered.—from Author's abstract

0097 **Lee, Sang Man.** Granites and migmatites in the South Hopewell Sound area, east of Hudson Bay, Province of Quebec, Canada: Geol. Soc. Korea Jour., v. 1, no. 1, p. 1–23, illus., tables, 1964.

In recent years much controversy has focused around the mechanism of emplacement of granitic rocks in the Earth's crust. Some geologists believe that granites are formed by mechanical injection of granitic magma; others support mechanisms of infiltration and replacement of country rock. This paper discusses the origin and mechanism of the migmatitic granites in Precambrian territories of New Quebec. An outward gradation is explained in terms of metasomatism, indicated not only by petrologic changes but also by mineral composition changes.—G.D.C.

Lemish, John. *See* Vredenburgh, L. D. 0351

0322 **Lenox, William E.** Lac Blanc field, Vermilion Parish, Louisiana *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 20–20c, illus., 1964.

0181 **Lewis, Jackson E.; Ross, Arnold.** Notes on the Eocene Brachyura of Florida: Florida Acad. Sci. Quart. Jour., v. 28, no. 3, p. 233–244, illus., 1965.

The Eocene Ocala Limestone in peninsular Florida contains a relatively small fauna of Brachyura (Malacostraca, Decapoda). Eight species, representing as many genera, have been recognized since 1959, including a new xanthid, *Palaeocarpilus brodkorbi* n. sp., which is herein described. Additional morphologic description is given for species of *Ocalina, Calappa, Calappilia,* and *Ranina,* from material recently collected from limerock quarries in the Williston Member of the Ocala.—V.M.J.

Littler, Janet. *See* Mead, Cynthia W. 0046

Lounsbury, Richard E. *See* Marcher, Melvin V. 0212

0340 **Lowrie, L. M.; Mickey, W. V.** Project Danny Boy—Seismic effects from a nuclear cratering experiment in basalt: U.S. Coast and Geod. Survey Rept. WT-1813, 57 p., illus., tables, 1965.

Measurements were made of surface earth motions in terms of displacement and velocity and acceleration at 12 locations from 760 m to 340 km from surface zero during Project Danny Boy, a 430 ton nuclear cratering explosion in basalt. Scaling functions for maximum earth particle displacements and accelerations from nuclear and high explosive cratering detonations are discussed. The explosion produced about 6.4×10^{16} ergs of source seismic energy or 0.35 percent of the total available source energy. Calculations for 5 different explosions indicate a decrease in seismic efficiency with increased event yield. Comparisons of seismic motions from high event yields in basalt and alluvium should show the relative source effects of the two media.—V.S.N.

0220 **Lozo, F. E.; Smith, C. I.** Revision of Comanche Cretaceous stratigraphic nomenclature, southern Edwards Plateau, southwest Texas: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 285–306, illus., geol. map, 1964.

The Devils River Formation and correlative Lower Cretaceous units here are divisible into three geologically distinct areas on the basis of different facies developments. Referred to as northern, central, and southern areas, the stratigraphic nomenclature is revised accordingly. In the northern area ammonite-bearing mudstones changing facies southward into rudist-miliolid limestones are divided by a disconformity into two formations. The limestone, undivided in the central area, is assigned to the Devils River Formation restricted to a narrow band encircling the southern or Maverick basin area. There three units are distinct, and new names are proposed—West Nueces, McKnight, and Salmon Peak Formations—to replace

the Edwards plus Comanche Peak, Kiamichi, and Georgetown, respectively.—G.D.C.

Lubke, E. R. *See* DeLuca, F. A. 0150

0186 **Lukert, M. T.; Winters, H. A.** The Kaneville esker, Kane County, Illinois: Illinois Acad. Sci. Trans., v. 58, no. 1, p. 3–10, illus., 1965.

A linear ridge consisting of sand and gravel, located in south-central Kane County, Ill., was interpreted to be an esker as early as 1899. Topographic configuration of the feature and associated landforms, sediments comprising the landform, alignment of these sediments, and nature and location of the associated materials support the eskering interpretation—Authors' abstract

0210 **Luther, Edward T.** Geologic map of the Campbells Station quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 65-NW, scale, 1:24,000, separate text, 1964.

The accompanying text, "Mineral resources summary of the Campbells Station quadrangle, Tennessee," by R. H. Barnes is cited separately.—M.C.M.

0120 **Lüttig, Gerd.** Interglacial and interstadial periods: Jour. Geology, v. 73, no. 4, p. 579–591, illus., 1965.

Previous definitions of an interglacial are regarded as unsatisfactory because they are not adequately multidisciplinary. A better definition can be based on climatology, reconstructed from movements of glacier margins. A "glaciation" curve, showing the position of the glacier margin versus time, best represents the climatology. Such a curve can be used to define four orders of kryomers (relatively cold periods) and four of thermomers (relatively warm periods). The ranks of various kryomers and thermomers are determined by the distance of the glacier margin from the center during maximum and minimum stands. Boundaries between them are placed at inflection points on the curve, which may roughly mark midpoints between maximum and minimum stands.—D.R.M.

Lyon, Ronald J. P. *See* Badgley, Peter C. 0270

0332 **Lysinger, Scott J.** Sweet Lake Field, Cameron Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 31–31c, illus., 1964.

0338 **MacClintock, Paul; Stewart, David P.** Pleistocene geology of the St. Lawrence Lowland: New York State Mus. and Sci. Service Bull. 394, 152 p., illus., geol. map, 1965.

In this area Cambrian and Ordovician sedimentary rocks dip gently northward off the Grenville rocks of the Adirondack Plateau. Outcrops and well records indicate that the Paleozoic surface is an almost flat broad lowland over which Pleistocene glaciers advanced. Two episodes of glaciation, the first from the northeast and the second from the northwest, are shown by striae and till fabric. Near Malone one drift rests on the other; the lower, red-brown even where weathered, is designated the Malone till; the upper one, slate gray where fresh, weathers to a yellow-gray buff and is designated the Fort Covington till for the major moraine it forms in that area. Details are discussed by quadrangles.—G.D.C.

0320 **Magbee, Byron D.** Kinder Field, Allen Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 18–18c, illus., 1964.

0238 **Malek-Aslani, M.** Exploration for petroleum in carbonate rocks [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 131, 1964.

0352 **Malloy, Richard J.** Gulf of Alaska—Seafloor upheaval: Geo-Marine Technology, v. 1, no. 5, p. 22–26, illus., 1965.

Soon after the disastrous Alaskan earthquake of 1964, the U.S. Coast and Geodetic Survey ship Surveyor conducted reconnaissance investigations near the epicentral area off Montague Island. Technical problems and results are summarized here, and comparisons made with other investigations and before-after data. The pattern of crustal uplift as contoured from 10 bathymetric cross-sections is similar to that mapped by the U.S. Geological Survey on the southwest end of Montague Island. Maximum uplift on land was 33 feet; tidal guage and other data suggest that the center of maximum uplift was seaward of Cape Cleare. Further study is needed to confirm this.—G.D.C.

0334 **Mann, C. John; Thomas, William A.** Cotton Valley Group (Jurassic) nomenclature, Louisiana and Arkansas: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 143–152, illus., table, 1964.

The several distinct lithofacies of the Late Jurassic subsurface Cotton Valley Group in these two states are masked by accepted stratigraphic terminology. Recent dense well control necessitates new names to emphasize lateral and vertical lithologic relationships. In Louisiana the following subdivisions are proposed for the Cotton Valley Group: the Knowles Limestone at the top, underlain 40 mi south of the Arkansas boundary by the white Terryville Sandstone; northward these are separated by the thickening gray Hico Shale, which contains five tongues from the Terryville Sandstone; underneath is the restricted Bossier Formation that pinches out northward. The gray shale-white sandstone sequence grades northward in Arkansas into a maroon succession retaining the name Schuler Formation (restricted).—G.D.C.

0212 **Marcher, Melvin V.; Lounsbury, Richard E.** Geologic map of the Deerfield quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 51-SW, scale, 1:24,000, separate text, 1964.

The accompanying text, "Mineral resources summary of the Deerfield quadrangle, Tennessee," by R. A. Miller is cited separately.—M.C.M.

Marvin, U. B. *See* Dodd, R. T., Jr. 0266

Matthée, H. *See* Klaer, P. 0110

0093 **Mayhew, E. Jay; Heylmun, Edgar B.** Concentrated subsurface brines in the Moab region, Utah: Utah Geol. and Mineralog. Survey Spec. Studies, no. 13, 28 p., illus., tables, 1965.

Wells drilled for oil and gas in the Paradox Basin of Utah have encountered supersaturated brines in rocks of Pennsylvanian, Mississippian, and Devonian age. Analyses indicate commercial possibilities for the extraction of minerals from the brines, particularly from the central part of the basin. Partial analyses of over 200 brine samples from wells drilled in southeastern Utah were used in formulating this report. The most concentrated brines have been found in Pennsylvanian rocks, especially in the thin clastic breaks which separate the salt beds in the Paradox Formation. In some cases, oil occurs along with the brine. Porous Mississippian carbonate rocks offer reservoir possibilities where faulted against the rich Paradox salt beds.—G.D.C.

McAllister, R. E. *See* Berger, J. 0023

0303 **McAndrews, Harry.** Geologic map of the Cooper Lake North quadrangle, Albany County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ-430, scale 1:24,000, 1965.

This map sheet includes a list of fossil collections on file with the U.S. Geological Survey. Megafossils were identified by W. A. Cobban; microfossils (spores and pollen) identified by R. H. Tschudy.—M.C.M.

McBirney, Alexander R. *See* Williams, Howel. 0300

0301 **McBirney, Alexander R.; Williams, Howel.** The origin of the Nicaraguan depression [abs.]: Bull. Volcanol., v. 27, p. 63, 1964.

0208 **McCary, Charles E. L.** Mineral resources summary of the Lynnville quadrangle, Tennessee: Nashville, Tennessee Div. Geology, 7 p., 1964.

This summary accompanies Tennessee Div. Geology Geol. Map 58-NE by C. W. Wilson, Jr. (cited separately), and describes the phosphate, chert, and limestone in the Lynnville quadrangle. The Bigby-Cannon Limestone is the source of the phosphate and is widely distributed throughout the quadrangle. Chert is residual from the Fort Payne Formation (Mississippian), and the principal sources of limestone are the Carters and Bigby-Cannon Limestones and the Leipers and Catheys Formations.—M.C.M.

0031 **McConnell, Duncan.** Precipitation of phosphates in sea water: Econ. Geology, v. 60, no. 5, p. 1059-1062, 1965.

Carbon dioxide is an essential component of the mineral substances of phosphorites, teeth, bones, etc. The role of carbonate ions has not been given adequate consideration in earlier theories on precipitation of phosphates. Analogies exist between the biochemical precipitation of carbonate apatites, with or without significant amounts of fluorine, and the formation of marine phosphorites. The principles of inorganic chemistry seem to be inadequate to account for phosphorites; various sorts of possible biochemical influences are suggested.—Author's abstract

0253 **McCulloch, David S.; Taylor, Dwight W.; Rubin, Meyer.** Stratigraphy, non-marine mollusks, and radiometric dates from Quaternary deposits in the Kotzebue Sound area, western Alaska: Jour. Geology, v. 73, no. 3, p. 442-452, illus., 1965.

Present knowledge of non-marine molluscan faunas does not permit subdividing deposits of late Illinoian and younger age. Radiocarbon ages of wood in deposits assigned Wisconsin to early Recent age range from >38,000 yr to 7,250 yr. Radiocarbon ages of wood in deposits assigned to the Sangamon Interglaciation and late Illinoian Glaciation are >42,000 yr. Marine sediments, in which occur shells giving Th-230/U-238 ages of 170,000 and 175,000 yr, are attributed to marine transgression during the Yarmouth Interglaciation.—R.E.W.

McIntyre, D. B. *See* Baird, A. K. 0359

0099 **McLeroy, Donald F.; Clemons, Russell E.** Carta geológica de México—Hoja Pedricenas, Estados de Coahuila y Durango: México, D. F., México Univ. Nac. Autónoma, Inst. Geología, scale 1:100,000, sections, text, 1965.

The comprehensive text covers in some detail the stratigraphic units from Triassic to Quaternary, intrusive rocks, structural geology, tectonics, and historical geology of the Pedricenas area. The principal mineral resources are copper, lead, zinc, silver, and gold.—M.C.M.

0285 **McMurtrey, R. G.; Konizeski, R. L.; Brietkrietz, Alex.** Geology and ground-water resources of the Missoula Basin, Montana: Montana Bur. Mines and Geology Bull. 47, 35 p., illus., tables, geol. map, 1965.

This wedge-shaped intermontane depression was formed during Late Cretaceous time in a Precambrian sedimentary rock terrane. It was downdropped on the northeast, overthrust on the southwest, and subject to recurrent movement until late Tertiary time. In Oligocene(?) time the basin was partly filled with perhaps 13,000 feet of erosional detritus from marginal highlands, interbedded with a little volcanic ejecta, and subsequently mantled by Pliocene(?) channel gravel, tilted again to the northeast, and filled with more than 200 feet of Pleistocene glaciolacustrine deposits. Gravity profiles and map indicate a maximum depth of fill of about 3,000 feet, and a total volume of about 25 cubic miles. Of about 30 million acre-feet of ground water in storage, about 8 million is available to wells; the principle source is the upper 200 feet of sediments.—G.D.C.

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0142 **McNulty, Charles L., Jr.** Hypolophid teeth from the Woodbine Formation, Tarrant County, Texas: Eclogae Geol. Helvetiae, v. 57, no. 2, p. 537–540, illus., 1964.

Isolated tritural teeth, occurring sparingly in lenses of phosphate sandstone in the uppermost Woodbine Formation near Southwest International Airport, were recovered by study of disaggregated rock under a stereoscopic microscope. They are virtually identical externally to *Hypolophus sylvestris*, but strikingly different internally. Thin sections show the Woodbine teeth to possess a heavy orthodentinal crown, whereas in *H. sylvestris* osteodentine appears to continue from root into most of the crown. The scanty histological information presented here suggests the hypolophids to be polyphyletic, in need of further study for assignment.—G.D.C.

0328 **McTee, Clifford R.** Opelousas Field, St. Landry Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 26–26f, illus., table, 1964.

0046 **Mead, Cynthia W.; Littler, Janet; Chao, E. C. T.** Metallic spheroids from Meteor Crater, Arizona: Am. Mineralogist, v. 50, nos. 5–6, p. 667–681, illus., tables, 1965.

The particles average 0.5 mm across and are characteristically coated by siliceous glass containing quartz. Some consist of a fine kamacite core intergrown and surrounded by a goethite-like iron oxide and maghemite. Schreibersite is interstitial to the kamacite. The spheroids probably condensed from a melt or vapor during impact of the meteorite.—E.H.R.

0323 **Melton, John R.** Lake Chicot field, St. Martin Parish, Louisiana *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 21–21d, illus., 1964.

0091 **Mero, John L.** The mineral resources of the sea: Amsterdam, Elsevier Publishing Co., 312 p., illus., tables, 1965.

From a study on manganese nodules, a project of the University of California Department of Mineral Technology at Berkeley and Institute of Marine Resources at San Diego, on the recovery of minerals from the sea, other materials of economic interest were noted and the program continued. In this study emphasis is on the region of surficial ocean-floor sediments which is a potential source of minerals now being mined in continental areas. Except for the continental shelves very little is known about the hard rock of the ocean floor.—G.D.C.

0152 **Merriam, Daniel F.; Harbaugh, John W.** Trend-surface analysis of regional and residual components of geologic structure in Kansas: Kansas Geol. Survey Spec. Distrib. Pub. 11, 27 p., illus., tables, 1964.

In areas of gently dipping strata small-scale structural features tend to be masked by those of regional magnitude. In subtracting the regional component to accentuate the small-scale features, a problem arises in deciding how much is regional and how much residual. Both the size of the area mapped and density of control points affect the shape of the regional and residual surfaces. Five areas of different size were studied in Kansas to compare these features and to study the relationship between residual features and oil fields. Trend surfaces can be fitted and contoured by high-speed electronic computers at low cost. It is suggested this technique be applied in oil exploration to predict horizon depths, emphasize the magnitude of unconformities, and project structural features.—G.D.C.

0171 **Merrill, William M.** Purposes of undergraduate degree programs in geology: Jour. Geol. Education, v. 13, no. 3, p. 67–70, illus., 1965.

Five proposals on a program for geology majors are: (1) not more than one geology course should be permitted in each semester of the undergraduate curriculum; (2) geology courses should emphasize development and evaluation of principles from facts; (3) laboratory hours should be part of each course with emphasis on appropriate field experience, and including one summer field course; (4) laboratory studies should introduce available routine analytical equipment, such as

spectrophotometers and computers; and (5) knowledge gained in mathematics, English, language, science, and humanities courses should be applied in geology classes.—M.C.

Messina, Angelina R. *See* Ellis, Brooks F. 0103

Mickey, W. V. *See* Lowrie, L. M. 0340

0130 **Middleton, G. V.** The Tukey chi-square test: Jour. Geology, v. 73, no. 3, p. 547–549, illus., 1965.

Tukey's modified chi-square test may be used in testing for preferred orientations in directional data. The test may be extended and applied to cases where the directional data are bimodal.—A.T.M.

0206 **Miller, Robert A.** Mineral resources summary of the Deerfield quadrangle, Tennessee: Nashville, Tennessee Div. Geology, 6 p., 1964.

This summary accompanies Tennessee Div. Geology Geol. Map GM 51-SW by M. V. Marcher and R. E. Lounsbury (cited separately) and describes the chert and limestone resources of the Deerfield quadrangle. The Fort Payne Chert is used to a great extent throughout this area as fill and for surfacing secondary roads. The only limestone deposits in this quadrangle are in the lower siltstone and limestone facies of the Fort Payne Chert. Potential resources are iron ore and sand and gravel.—M.C.M.

Miller, Robert A. *See* Wilson, Charles W., Jr. 0209

0245 **Milling, Marcus E.; Tuttle, Sherwood D.** Morphometric study of two drainage basins near Iowa City, Iowa: Iowa Acad. Sci. Proc. 1964, v. 71, p. 304–319, illus., tables, 1965.

A morphometric study was made of the adjoining drainage basins of east-flowing Old Man Creek and Clear Creek in Johnson and Iowa counties, Iowa. In terms of the parameters measured, these basins are essentially similar. They agree with "laws" for drainage basins proposed by Horton and are therefore "normal" rather than "misfit". Part of the Clear Creek basin was invaded by Iowan ice and this probably accounts for some abnormal data. Distinct longitudinal asymetry and obviously steeper south valley walls are probably best explained by the differences in loess thickness on valley sides.—Author's abstract

0356 **Milton, Charles; Ingram, Blanche; Clark, Joan R.; Dwornik, Edward J.** Mckelveyite, a new hydrous sodium barium rare-earth uranium carbonate mineral from the Green River formation, Wyoming: Am. Mineralogist, v. 50, nos. 5–6, p. 593–612, illus., tables, 1965.

Mckelveyite, with essentially yttria rare earths, occurs in four subsurface localities in Sweetwater County, Wyo., together with burbankite, a cerium rare-earth mineral. The space group, cell volume, and observed X-ray diffraction powder lines of its trigonal crystals are discussed. Two types are known, one in apple green crystals, and one, dark green or black, massive and in crystal aggregates. The forms observed are given. Mckelveyite is uniaxial, negative, ϵ 1.57, ω 1.66, pleochroic, green. The mineral is named in honor of Vincent E. McKelvey, geologist of the U.S. Geological Survey.—J.R.C.

0178 **Moore, James G.; Peck, Dallas L.** Bathymetric, topographic, and structural map of the south-central flank of Kilauea Volcano, Hawaii: U.S. Geol. Survey Misc. Geol. Inv. Map I-456, scale 1:62,500, section, 1965.

Indicated on the map are eruptive vents, cinder cones, and cracks; pit craters; cracks and faults; inferred ocean bottom faults; and inferred limit of submarine landslides. A section shows the Hilina fault system. The contour interval is 25 meters.—M.C.M.

0349 **Moore, Paul B.** Hühnerkobelite crystals from the Palermo No. 1 pegmatite, North Groton, New Hampshire: Am. Mineralogist, v. 50, nos. 5–6, p. 713–717, illus., tables, 1965.

Crystals of the phosphate mineral hühnerkobelite are short and prismatic. Morpholotical and structure cell data and space group are given. Chemical composition includes $FeO = 19.2 \pm 0.2$; $Fe_2O_3 = 11.4 \pm 0.5$; $MnO = 8.0 \pm 0.4$.—M.L.L.

0101 **Moore, Richard T.; Wilson, Eldred D.** Bibliography of the geology and mineral resources of Arizona, 1848–1964: Arizona Bur. Mines Bull. 173, 321 p., 1965.

This bibliography is a comprehensive list of the literature released through December 1964 and includes, besides regularly published items, many theses and open-file reports. Bibliographic items are grouped alphabetically under the surname of the senior author and chronologically under the name. A cross-referenced index accompanies the bibliography.—M.C.

0218 **Moredock, Duane E.; VanSiclen, DeWitt C.** Regional variations of hydrocarbons in the Edwards limestone (Cretaceous) of South Texas: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 253–270, illus., tables, 1964.

Analyses of gas in this thick limestone formation show that the percentage of methane decreases up-dip to the northwest, while heavier hydrocarbons increase correspondingly; isocomposition lines, however, trend more easterly than the structure contours and reef contact facies. The non-hydrocarbon gases tend to follow the heavier hydrocarbons, except around three salt dome fields in McMullen County, where abnormally high concentrations are attributed to sulfate reducing bacteria and vertical migration. Meteoric water entering the Edwards Formation from Mexico and southwestern Texas added a northeasterly component to the principal up-dip expellation of formation fluids, causing the reversed distribution.—G.D.C.

0281 **Motts, Ward S.** Hydrologic types of playas and closed valleys and some relations of hydrology to playa geology, [Chap.] 3 *in* Geology, mineralogy, and hydrology of U.S. playas: U.S. Air Force Cambridge Research Labs., Environmental Research Paper 96 (AFCRL-65-266), p. 73–104, illus., tables, 1965.

Playas are situated in closed valleys with a variety of hydrologic patterns. Ground water entering the basin may flow through, around, or under a playa and some, all, or none of it may discharge through the playa surface. Each degree of interchange may produce a distinctive set of surface conditions which have control of development of soils, landforms, and vegetation. Because they appear to be influenced greatly by hydrology, several playa classifications relating composition and amount of ground-water discharge are possible. Rate and amount of discharge appear to control directly the solutioning, deflation, and phreatophyte and spring-mound growth. Falling water tables may produce large-scale desiccation phenomena and contribute to degree of aggradation.—M.C.

0350 **Mound, Michael C.** *Kladognathus* Rexroad, 1958, not *Cladognathodus* Rexroad and Collinson, 1961: Micropaleontology, v. 11, no. 3, p. 372–373, 1965.

Cladognathodus Rexroad and Collinson, 1961, must be rejected as an unjustified emendation with status as a junior objective synonym of the conodont generic name *Kladognathus* Rexroad, 1958.—Author's abstract

Moye, D. G. *See* Goodman, R. E. 0115

Mrose, Mary E. *See* Schaller, Waldemar T. 0044

Mueller, Robert F. *See* Sharma, Taleshwar. 0279

0086 **Murthy, V. Rama; Sandoval, P.** Chromium isotopes in meteorites: Jour. Geophys. Research, v. 70, no. 17, p. 4379–4382, tables, 1965.

The Cr isotopic composition was measured in 4 chondrules, 8 whole chondrite samples, and 2 iron meteorites. No isotopic variations within the limits of error (1 percent) were found, either among these objects or between thorites and Earth. It is concluded that either there has been no significant high-energy proton irradiation in the early solar system, or chondrules, chondrites, and iron meteorites are all secondary objects derived from a primordial condensate after complete isotope homogenization.—D.B.V.

0217 **Myers, Robert L.; VanSiclen, DeWitt C.** Dynamic phenomena of sediment compaction in Matagorda County, Texas: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 241–252, illus., tables, 1964.

Observations from four wells in Trull Field show that density in the Oligocene shales does not increase regularly with depth below 8,000 feet. High interstitial fluid pressures in the associated sands are caused by compaction where thick sections of shale impede expulsion. Part of the weight of the rock frame is transferred to the water, restricting the degree of compaction of the shales as compared to well-drained sections. Saline water is present in the sands, but the salts are held by the clay minerals of the associated shales so strongly that they do not accompany the expelled water. Some effects of the dynamic compaction phenomena on the migration and entrapment of hydrocarbons, drilling technology, and exploration are presented.—G.D.C.

Nafe, John E. *See* Landisman, Mark. 0080

0096 **Namowitz, S. N.** Activities in earth science (revised edition), *to accompany* Earth science—The world we live in: Princeton, N. J., D. Van Nostrand Company, 188 p., illus., 1965.

In this revised workbook, basic changes have been made to reflect new emphasis in the teaching of earth science, especially in the area of laboratory investigations. Many of the new exercises require the student to employ fundamental laboratory techniques in the performance of experiments, and to make judgements or inferences on the basis of the experimental data that should stimulate scientific thinking; most fall in the area of the Earth and the Universe and the Crust of the Earth. The 53 exercises included will provide sufficient flexibility for adjusting the laboratory program to the requirements of the course syllabus and local conditions.—G.D.C.

0286 **Nayudu, Y. R.; Enbysk, B. J.** Bio-lithology of northeast Pacific surface sediments: Marine Geology, v. 2, no. 4, p. 310–342, illus., tables, 1964.

Seven biolithologic areas are defined for the northeast Pacific surface sediments from a study of more than 200 gravity cores as follows: northern terrigeneous sediments with <20 percent diatoms; diatom-rich sediments with >20 percent diatoms; glacial marine remnant with diatoms; Katmai volcanic ash; radiolaria-rich or biologically barren sediments; Globigerina-rich sediments; and terrigenous sediments of outer shelf, slope, and Great Trough, southern region. Topography and major ocean currents seem most responsible for the sedimentation patterns observed. Bathymetry, core locations, and bio-lithology are shown on maps; core data are tabulated; and photomicrographs of some sediments illustrated.—V.S.N.

0298 **Nayudu, Y. Rammohanroy.** Palagonite tuffs (hyaloclastites) and the products of post-eruptive processes: Bull. Volcanol., v. 27, p. 391–410, illus., 1964.

Studies are reviewed of pillow-lava palagonite complexes from Columbia River basalts, from the central Oregon coast, and Iceland, and of manganese nodules from Pacific Ocean floor, and additional petrologic and X-ray diffraction data for selected samples are presented. Available data on manganese deposits associated with submarine volcanism and petrologic studies indicate a genetic relationship between palagonite tuffs and ferromanganese minerals of the nodules. The study suggests that some of the red clays associated with manganese minerals are alteration products of palagonite tuffs, and zeolites and montmorillonite are important post-eruptive products of palagonite. Pertinent results from the studies of palagonitized basalt from the experimental Mohole drilling are discussed also.—M.C.M.

0112 **Neal, James T.** Tectonic influences on playa morphology, [Chap.] 4 *in* Geology, mineralogy, and hydrology of U.S. playas: U.S. Air Force Cambridge Research Labs., Environmental Research Paper 96 (AFCRL-65-266), p. 105-121, illus., 1965.

Playas in western middle North America have undergone a complex geologic history which is still not clearly understood. Complexity of geology does not determine if a playa will exist in a particular basin, but rather a combination of topographic, meteorologic, hydrologic, and historical geologic effects determines their emplacement. Playas show numerous tectonic and structural manifestations as demonstrated by the effects of faulting, isostatic adjustment, thermal springs, and large-scale contraction of sediments.—M.C.

0213 **Neal, James T.** Environmental setting and general surface characteristics of playas, [Chap.] 1 *in* Geology, mineralogy, and hydrology of U.S. playas: U.S. Air Force Cambridge Research Labs., Environmental Research Paper 96 (AFCRL-65-266), p. 1-29, illus., tables, 1965.

Playas in the United States occur in desert basins of the western Basin and Range province. Most were sites of old Pleistocene lakes and received large amounts of lacustrine sediments now being modified by environmental processes. Their surfaces range from hard, dry, compact crusts to salt pavements or to carbonate or mixed surfaces, which can be correlated with the mineralogy and ground-water features. Water-table fluctuations are modifying the usual flat smooth surfaces and producing giant fissures, phreatophyte mounds, and salt thrust features. The playas are best characterized as dynamic landforms, highly sensitive to environmental changes and exhibiting a variety of effects under constant adjustment to new environments.—M.C.

0045 **Neathery, Thorton L.** Paragonite pseudomorphs after kyanite from Turkey Heaven Mountain, Cleburne County, Alabama: Am. Mineralogist, v. 50, nos. 5-6, p. 718-723, illus., tables, 1965.

Retrogressive alteration of kyanite to paragonite occurs where greatest secondary deformation is observed. Partial release of stresses in the presence of metasomatic solutions is indicated. Sp. gr. is 2.85 ± 0.05; optical properties and basal spacings are given along with that for associated muscovite.—M.L.L.

0098 **Nelson, Daniel J.** Strontium in calcite—New analyses: Inst. Marine Sci. Pub., v. 10, p. 76-79, illus., table, 1965.

Calcite specimens from the Brush Mineralogical Laboratory, Yale University, were analyzed for Sr and Ca and were considered a reference material to resolve a difference in published values for Sr-Ca ratios in freshwater mollusks. The new analyses showed the earlier published Sr concentrations were high by as much as an order of magnitude. These new data extend the lower range of Sr-Ca ratios in naturally occurring calcium carbonate minerals to 0.0224 Sr atoms per 1,000 Ca atoms.—Author's abstract

0073 **Newcomb, R. C.** Geology and ground-water resources of the Walla Walla River basin, Washington-Oregon: Washington Div. Water Resources Water Supply Bull. 21, 151 p., illus., tables, geol. maps, 1965.

In this sloping basin the Columbia River basalt, exposed in the canyons of the Blue Mountains, has dips which converge into a synclinal trough whose faulted bedrock surface extends below sea level west of Walla Walla. Thick deposits of Pleistocene clay and gravel partly filling this trough are overlain in places by successively younger deposits and Recent alluvium of the broad valley beyond Walla Walla. Ground water occurs in the old gravel, which in places has a mantle of water-bearing Recent alluvium, and in the basalt, confined by the old clay and dammed in places by faults and folds. Recharge is greater than the present withdrawal of water.—G.D.C.

0274 **Newmark, N. M.** Effects of earthquakes on dams and embankments: Géotechnique, v. 15, no. 2, p. 139-159, illus., tables, 1965.

During earthquakes, the Earth moves in random fashion both horizontally and vertically. One of the most intense strong motion records available is that for El Centro, Calif., May 18, 1940, when maximum ground acceleration was 0.32 g, maximum ground velocity 13.7 in. per sec, maximum ground displacement 8.3 in. and duration of major motion 30 sec. Figures for a maximum probable earthquake in California would be 0.50 g, 24–30 in. per sec, 24 in., and 90–120 sec respectively. Motion of earth or rock-fill dams or of an embankment subjected to an earthquake may be motion of a block, wedge, or slice of the upstream or downstream slope usually out and downhill, motion of dam as a whole block, or relative motions in either the dam or the foundation causing fissures, usually vertical. To make dams resistant to earthquake motion, the static resistance of the dam should be greater than maximum earthquake likely to be encountered.—M.C.

0255 **Newton, Robert C.** The thermal stability of zoisite: Jour. Geology, v. 73, no. 3, p. 431–440, illus., tables, 1965.

The equilibrium pressure-temperature curve for the reaction zoisite = anorthite + grossularite + corundum + vapor was determined experimentally in hydrothermal "rod-bombs" and the piston-cylinder solid-pressure apparatus in the pressure range 2–7 kb. Natural zoisite, anorthite, and grossularite were used as starting material. The dehydration temperature of zoisite at 2,000 bars is 574° ± 7°C, and the slope at that point is 18.1 bars/°C. The curve in the range 200–2,000 bars was calculated on the basis of the experimental data.—Author's abstract

0216 **Nichols, Paul H.** The remaining frontiers for exploration in Northeast Texas: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 7–22, illus., 1964.

Two areas of promise are advanced to justify future Mesozoic exploration—northeast Texas, proper, and the Angelina-Caldwell trend. The Smackover Formation of Upper Jurassic age is the oldest favorable Mesozoic reservoir. In the absence of porosity here, the next oldest potential interval is the Cotton Valley Group, the exploration of which involves deeper drilling on proven structures. The Angelina-Caldwell trend is relatively untested in the Mesozoic, but favorable facies are inferred for time-rock equivalents of the Louann Salt to Eagle Ford Formations. Because of the present homoclinal dip southward, any loss of porosity is caused by facies change or truncation. Lithofacies maps illustrate the paleogeology outlined.—G.D.C.

Nickelsen, R. P. *See* Prucha, J. J. 0029

0132 **Nissen, H.-U.** The preferred orientation of an elliptical cylinder in a potential flow field—A reply [to discussion by W. H. Graf, 1965]: Jour. Geology, v. 73, no. 3, p. 552, 1965.

Of two possible orientations of elongated crinoid disks with respect to the direction of flow, that perpendicular to the direction of flow is evidenced by other sedimentary structures.—A.T.M.

0144 **Nugent, R. C.; Banks, D. C.** Project Sulky—Preshot geologic investigations, preliminary report: U.S. Army Engineer Waterways Expt. Sta. Rept. PNE-719P, 87 p., illus., tables, 1965.

Comprehensive geologic and engineering studies made on Buckboard Mesa at the Nevada Test Site for the Sulky event, a nuclear cratering experiment conducted in dry basalt, are discussed. Six borings were used to determine foundation conditions at depths from 59 to 212 feet. Existing subsurface data do not confirm the presence of faults, although very conspicuous high angle joint sets are present. A joint frequency curve shows local fluctuations but no significant change in frequency of joints with depth. Geophysical logging of foundation materials shows that average physical property values are in close agreement with those in laboratory tests and related to vesicularity of basalt. Water pressure tests showed no relationship to bulk porosity value of rock.—M.C.

0018 **Nybakken, Bette Halvorsen; Reeder, William G.** A soil sequence from southwestern Umnak Island, Alaska: Northwest Sci., v. 39, no. 3, p. 104–117, illus., tables, 1965.

Southwestern Umnak Island is dominated by two glaciated volcanic peaks, at least one of which has erupted in historic time. Due to recurrent ash falls there are several lithologic discontinuities in each of 3 soil profiles in the Nikolski area to the southwest. The underlying bedrock is argillite which is jointed and layered when found close to the surface at the hilltop, where an almost constant wind apparently scoured off the ash that fell there. Weathered till found at the bottom of all pits dug in the vicinity of the village of Nikolski, becomes thicker downslope. The ash layers in the section have not been deep enough to protect the buried soil from effects of root penetration, leaching, and weathering.—G.D.C.

0250 **O'Brien, Neal R.; Orlopp, Donald E.** Correlation of kaolinite morphology and crystallinity: Illinois Acad. Sci. Trans., v. 57, no. 2, p. 84–87, illus., 1964.

Three kaolinite samples with varying degrees of crystallinity, determined by X-ray diffraction analysis, were studied with the electron microscope to determine the relationship of crystallinity and morphology. Samples were "Georgia kaolinite" from Georgia and a clay and flinty clay, respectively from Illinois and Indiana. The Georgia sample showed sharp reflections indicating well-crystallized kaolinite in the X-ray trace and its electron micrograph confirmed this in the sharp hexagonal outlines of the platelets, thus showing a correlation between hexagonal outline and well-developed crystallinity. Neither of the others had such marked crystallinity and the deteriorated state of their crystalline perfection may be due to plastic deformation along the b-axis and strain along the a-axis. Perfection of internal order does not appear to condition the hexagonal shape of platelets.—M.C.

0182 **Ogden, J. Gordon, 3d.** Pleistocene pollen records from eastern North America: Bot. Rev., v. 31, no. 3, p. 481–504, 1965.

Literature on Pleistocene pollen records is reviewed for the 30-yr period following the first review of pollen analysis in North America, by P. B. Sears (1935). The literature is discussed under the topics: pre- and early Wisconsin interglacial and interstadial pollen records; Wisconsin pollen records (late-glacial; *Quercus* pollen in late-glacial zones; postglacial; hypsithermal); modern pollen flora and vegetational records; plant macrofossils and fossils other than pollen; pollen analysis as related to Pleistocene mammal remains, archeology, sea-level rise; trends and prospects of pollen analysis. Bibliographic references are cited in an eight page list.—V.M.J.

Orlopp, Donald E. *See* O'Brien, Neal R. 0250

Owen, D. E. *See* Fisher, W. L. 0013

0230 **Owen, Edgar W.** An historical sketch of petroleum geology in the Gulf Coast region [Pt. 1]: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 51–65, 1964.

Oil and gas fields in the Gulf Coast region occur in remarkably diverse types of habitats in widespread formations of Jurassic to Pleistocene age. Few of the productive facies of host rocks crop out, and the acquisition of definite subsurface information was long neglected. Development of the region has required unusually varied techniques and concepts. A cyclical history of rapid expansion after each discovery of new productive trends and each exploitation of new exploration techniques has intervening periods of diminishing returns and pessimism. This article is the first half of a summary of the regional history.—G.D.C.

0239 **Owen, Edgar W.** Some facies of regional history [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 1, 1964.

Palmquist, J. C. *See* Hoppin, R. A. 0027

0260 **Pan Am. Union Dept. Econ. Affairs.** Costa Rica—Annotated index of aerial photographic coverage and mapping of topography and natural resources [English

and Spanish texts]: Washington, D. C., Pan American Union, 13 p., illus., tables, 1965.

Natural resource data collection in Costa Rica is done by a number of educational centers, national and international agencies, and private companies, all of which are listed in the text. The primary agency for geologic information is the Departamento de Geología, Minas y Petróleo, although at present there is no national geologic mapping program. The two major maps of the geology of Costa Rica were published by the U.S. Geological Survey in 1957 and by the Departamento de Geología, Minas y Petróleo in 1963. Included in this index also are topographic, planimetric, soils, land capability, vegetation, ecology, and other mapping.—M.C.M.

0261 **Pan Am. Union Dept. Econ. Affairs.** Panama—Annotated index of aerial photographic coverage and mapping of topography and natural resources [English and Spanish texts]: Washington, D. C., Pan American Union, 13 p., illus., tables, 1965.

Heretofore mapping in Panama has been the responsibility of the Ministerio de Agricultura, Comercio e Industria and the Ministerio de Obras Públicas, but a cooperative program of the Government of Panama and the U.S. Agency for International Development, along with private firms, will undertake a comprehensive mapping study. There is little geologic mapping available for Panama, but two good small scale maps have been published; one by the U.S. Geological Survey in 1957, and the other by the California Academy of Sciences in 1956. This index includes mapping of topography, planimetry, soils and land capability, vegetation, ecology, land use, and forest inventory.—M.C.M.

0262 **Pan Am. Union Dept. Econ. Affairs.** Honduras—Annotated index of aerial photographic coverage and mapping of topography and natural resources [English and Spanish texts]: Washington, D. C., Pan American Union, 11 p., illus., tables, 1965.

In Honduras most mapping and natural resource survey work is carried out in cooperation with various international agencies, all of which are listed in the text. There is no government agency responsible for geologic mapping, so the work has been done for the most part by private minerals and petroleum exploration companies, university and consulting geologists, and the U.S. Geological Survey. The three general geologic studies of the country are by K. T. Sapper (1937), R. J. Roberts and E. M. Irving (1957), and R. Weyl (1960). There are only a few geologic maps and studies specifically concerned with Honduras, none of which cover the entire country. In addition to geologic, topographic and planimetric mapping, the index includes soils and land capability, vegetation, ecology, land use, and forest inventory mapping.—M.C.M.

0263 **Pan Am. Union Dept. Econ. Affairs.** Guatemala—Annotated index of aerial photographic coverage and mapping of topography and natural resources [English and Spanish texts]: Washington, D. C., Pan American Union, 13 p., illus., tables, 1965.

Both national and international agencies have been active in Guatemala in the production of maps, a list of which is included in the text. In 1961 a joint geologic mapping program was initiated for the investigation of non-metallic mineral resources, but much of this mapping has not yet been published. Northern Guatemala has been mapped by oil exploration companies, but this material is not currently available for public circulation. In addition to geologic, topographic and planimetric mapping, the index covers soils and land capability, vegetation, ecology, land use, and forest inventory mapping.—M.C.M.

0289 **Pan Am. Union Dept. Econ. Affairs.** El Salvador—Annotated index of aerial photographic coverage and mapping of topography and natural resources [English and Spanish texts]: Washington, D. C., Pan American Union, 11 p., illus., tables, 1965.

El Salvador has three active mapping programs conducted by government agencies, in addition to other resource data collection programs in progress. Agencies

involved are listed in the text. The agency responsible for geologic mapping is Centro de Estudios e Investigaciones Geotécnicas, superseding Servicio Geológico Nacional. Investigations of SGN were primarily on geothermal energy exploitation, but a number of reconnaissance and semi-detailed geologic maps were produced by them and other investigations, some of which cover the entire country, others regions of special interest. Maps and other geologic reports are listed in "Inventario de Estudios Básicos sobre Recursos Naturales de Centroamérica" by Gabriel Dengo (1963). In addition to topographic, planimetric, and geologic mapping, the index includes soils and land capability, vegetation, land use, forest inventory, and ecologic mapping.—M.C.M.

0290 **Pan Am. Union Dept. Econ. Affairs.** Nicaragua—Annotated index of aerial photographic coverage and mapping of topography and natural resources [English and Spanish texts]: Washington, D. C., Pan American Union, 13 p., illus., tables, 1965.

A number of national and international agencies (listed in text) are engaged in mapping programs in Nicaragua. The Servicio Geológico Nacional has published geologic reports and maps for scattered areas in the northwest, Pacific coast, and southern Atlantic coast; a generalized geologic map in 1957; and in 1962, a bibliography of geologic work done in the country. In addition to geologic, topographic, and planimetric mapping, the index includes soils and land capability, vegetation, ecology, land use, and forest inventory mapping.—M.C.M.

0353 **Papike, J. J.; Zoltai, Tibor.** The crystal structure of a marialite scapolite: Am. Mineralogist, v. 50, nos. 5–6, p. 641–655, illus., tables, 1965.

The crystal structure of an 80.6 percent marialite scapolite, with $a = 12.060$ Å ± .003, $c = 7.572$ Å ± .003, and space group $I4/m$ was determined and refined. Three dimensional intensities were collected with an equi-inclination, single-crystal diffractometer on a spherical crystal of scapolite from Gooderham, Ontario. After several unsuccessful attempts at refining the model proposed by Pauling (1930), and Schiebold and Seumel (1932), the three-dimensional Patterson function was computed and solved for an approximation of the structure with the minimum function method. This model was completed and refined by Fourier and least squares methods. . . . Average T-O distances are 1.608 Å in the first and 1.665 Å in the second tetrahedron, with Al restricted to the second tetrahedral position.—Authors' abstract

0368 **Peck, A. J.** Moisture profile development and air compressions during water uptake by bonded porous bodies—[Pt.] 3, Vertical columns: Soil Sci., v. 100, no. 1, p. 44–51, illus., 1965.

The water uptake or infiltration rate was studied in detail for bonded (slate dust) and unbonded (sand) columns of various lengths. The moisture profile and pore-air pressure were measured for each type of column. The method, however, does not take into account lateral movement, large pores found in soils, structural fissures, or impermeable surface crusts.—J.W.H.

Peck, Dallas L. *See* Moore, James G. 0178

0234 **Pérez Fernández, Raúl; Díaz G., Teodoro.** Jurassic data from wells in Northeastern Mexico [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 231–232, illus., 1964.

0361 **Peterson, Ulrich.** Application of saturation (solubility) diagrams to problems in ore deposits: Econ. Geology, v. 60, no. 5, p. 853–893, illus., 1965.

Saturation diagrams are used to illustrate a variety of processes that take place during ore deposition, and to provide insight into the meaning of observed paragenetic relationships. The effects of the following processes can be diagrammed for two-, three-, and four-component systems: variation of temperature, pressure, and "additional components"; isothermal-isobaric evaporation; congruent and incongruent solution; precipitation by dilution and by changes in solubility. The diagrams are particularly useful for analyzing the significance of reaction rims, relations between incompatible minerals, and absence of expected minerals. Many

of the illustrative examples involve sulfantimonides and sulfarsenides typical of the mining districts of Central Peru.—W.S.W.

0324 **Phillips, Harris E.** Lakeside Field, Cameron Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 22–22c, illus., 1964.

Pike, James W. *See* Conkin, James E. 0053

Popenoe, Peter. *See* Boynton, G. R. 0167

Popenoe, Peter. *See* Boynton, G. R. 0175

Popenoe, Peter. *See* Boynton, G. R. 0176

0158 **Price, R. J.** The changing proglacial environment of the Casement Glacier, Glacier Bay, Alaska: Inst. British Geographers Trans., no. 36, p. 107–116, illus., 1965.

Ground and air photographs taken on eight occasions between 1907 and 1958 and field work carried out in 1962 make possible the reconstruction of proglacial conditions near the Casement Glacier. The development of landforms, due to fluvioglacial erosion and deposition associated with the ice wastage, is discussed. The importance of the form of the subglacial and proglacial surface in determining the type of fluvioglacial activity is examined. Air photographs taken in 1946 and 1948 make possible an analysis of the changes in the extent and thickness of the glacier, and of the changes in direction and amount of fluvioglacial erosion that have taken place during the last 16 years.—Author's abstract

0205 **Price, Robert C.; Dever, Garland R., Jr.** Oil and gas map, Sulphur Well quadrangle, Kentucky: Lexington, Kentucky Geol. Survey, ser. 10, scale 1:24,000, 1964.

0029 **Prucha, J. J.; Graham, J. A.; Nickelsen, R. P.** Basement-controlled deformation in Wyoming province of Rocky Mountains foreland: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 966–992, illus., 1965.

The Precambrian basement of the Rocky Mountains foreland in Montana, Wyoming, Colorado, and New Mexico was closely involved in the Laramide deformation. During this deformation the basement was covered generally by 8,000–15,000 feet of sedimentary rocks. The dominant structural style of this region is basement block faulting of diverse trends and great structural relief. Individual blocks are bounded by upthrust faults which commonly die out upward into monoclinal flexures in the overlying sedimentary rocks.—A.E.R.

Radtke, Arthur S. *See* Taylor, Charles M. 0196

0224 **Rainwater, E. H.** Transgressions and regressions in the Gulf Coast Tertiary: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 217–230, illus., 1964.

Sea-level deposits of Tertiary age are now buried at least 20,000 feet, so there can be no doubt of a subsiding coastal area in Louisiana and Texas. The alternating sequence of sediments resulted from advance and retreat of the strandline, due to differential rates of subsidence and sedimentation, and locally to shifting of large deltas, which build seaward as long as sediment supply is greater than subsidence. The more regional transgressions of Paleocene to Miocene time suggest a small supply, possibly the result of a dry climate in the source areas. Continued sinking of the coast permitted the sea to cover coastal plains of preceding periods of abundant supply. The rate of sedimentation is believed to have been much greater in regressive periods.—G.D.C.

0292 **Rainwater, E. H.** Regional stratigraphy of the Gulf Coast Miocene: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 81–124, illus., tables, 1964.

The depositional history of the terrigenous clastic Miocene of the western Gulf Coast and the carbonate sediments of the eastern Gulf Miocene is described and illustrated. Special attention is given the very thick Miocene deposits of the ancestral Mississippi River in southern Louisiana and adjacent offshore. This wedge of regressive, mainly deltaic, sand, silt and shale and transgressive marine shale is highly productive of oil and gas. Ten divisions, based on top ranges and assemblages of benthonic Foraminifera, are proposed, and a representative section is given for each division. The factors responsible for making this area most favorable for hydrocarbon occurrences are emphasized.—G.D.C.

0092 **Ramsey, William L.; Burckley, Raymond A.** Modern earth science (2d edition, revised): New York, Holt, Rinehart and Winston, 664 p., illus., tables, 1965; originally published 1961.

In this textbook, a unit on substances known to make up the Earth's crust including the role of chemistry precedes the detailed discussion of the Earth's surface features and the forces that shape them. Two units deal with major landforms and their origin, a unit is devoted to Earth's history as revealed by the fossil record, and concluding units deal with the water supply and atmosphere. A new feature of the book, titled *A Closer Look*, at the end of each chapter opens up discussion of a specific area of the main topic, or an area of possible enrichment. The appendix includes a key for identification of minerals, and a glossary of terms.—G.D.C.

Randolph, E. Richard. *See* Anderson, Gerald J. 0134

0139 **Rasetti, Franco.** Upper Cambrian trilobite faunas of northeastern Tennessee: Smithsonian Misc. Colln. (Smithsonian Inst. Pub. 4598), v. 148, no. 3, 127 p., illus., tables, 1965.

Upper Cambrian trilobites have been found in eight counties in the northeast part of the State, primarily in limestone portions of the Nolichucky Formation, and, in Hawkins County, in the upper Maryville Limestone. Trilobites are found in the Nolichucky in three zones, the *Aphelaspis*, the *Crepicephalus*, and the *Cedaria*, the latter also the source in the Maryville Limestone. Detailed systematic descriptions cover Upper Cambrian trilobite species from measured sections and include two species of Agnostida, one of Corynexochida, and new species from 11 families of the Ptychopariida, plus 12 Ptychopariida of uncertain affinities, and four undetermined trilobites. Type catalog numbers and localities of previously described species are given for those from the southern Appalachians.—M.C.

Raymond, J. R. *See* Brown, R. E. 0085

Redfield, Robert C. *See* Eck, William. 0117

Reeder, William G. *See* Nybakken, Bette Halvorsen. 0018

0035 **Reso, Anthony.** The geology of Colorado oil shale and its economic potentialities [abs.]: Houston Geol. Soc. Bull., v. 8, no. 1, p. 3–4, 1965.

Rieke, Herman H. *See* Robertson, John O., Jr. 0203

Rivette, John L. *See* Forgotson, James M., Jr. 0232

0357 **Roberson, Herman E.; Jonas, Edward C.** Clay minerals intermediate between illite and montmorillonite: Am. Mineralogist, v. 50, nos. 5–6, p. 766–770, illus., table, 1965.

A 2–4 micron fraction of clay minerals from a bentonite clay from the Tertiary of the Gulf Coast contains material that apparently is intermediate between illite and montmorillonite. This material resembles illite in that it does not expand after exchange with Na^+, K^+, or Ca^{2+}, but, like montmorillonite, the interlayer ions are exchangeable.—R.S.F.

0203 **Robertson, John O., Jr.; Rieke, Herman H.; Chilingar, George V.** Viscosity measurements of aqueous clay suspensions as a tool for determining mineralogic type of clays: Sedimentology, v. 4, no. 3, p. 181–187, illus., table, 1965.

Study of viscosity of clay–water systems as opposed to weight percent of clay (or density) curves for various clays can aid in rapid mineralogic identification of clays. By measuring the density of a mud sample and determining the viscosity of this dispersed system, a rough determination of the mineralogic composition of the clay can be made using graphs. Because apparatus for viscosity determination of mud samples is simple and will yield measurements in a very short time, this technique is recommended. Each laboratory must prepare its own set of curves for various known clays and clay mixtures from results of its own viscosimeter. More research is needed before use of the swelling index is applied to definite clay identification, mainly because the calculated swelling index varies with different concentrations of a particular clay.—M.C.

0314 **Robinson, E. C.** Gueydan Field, Acadia and Vermilion Parishes, Louisiana, *in* Typical oil and gas fields of southwestern Lousiana: Lafayette, La., Lafayette Geol. Soc., p. 12–12d, illus., 1964.

Robinson, G. D. *See* Davis, W. E. 0168

0297 **Robson, G. R.; Barr, K. G.** The effect of stress on faulting and minor intrusions in the vicinity of a magma body: Bull. Volcanol., v. 27, p. 315–330, illus., table, 1964.

The stress field in the vicinity of a body of fluid of simple shape within a nonhomogeneously stressed solid has been calculated and applied to the case of a magma body in the crust subjected to triaxial stresses; the resulting types of faulting and minor intrusion are described. The theory indicates that regional stresses in the crust, together with magma pressure, control the type of faulting, form of minor intrusions and occurrence of eruptions from the magma body. The stress conditions favoring the formations of calderas, radial dikes, dike swarms, and cone sheets are described.—D.B.V.

Rodenberg, Keith. *See* Rohr, Gene M. 0244

0355 **Roedder, Edwin.** A laboratory reconnaissance of the liquidus surface in the pyroxene system En–Di–Hd–Fs ($Mg\ SiO_3$–$CaMgSi_2O_6$–$CaFeSi_2O_6$–$FeSiO_3$): Am. Mineralogist, v. 50, nos. 5–6, p. 696–703, illus., tables, 1965.

Quenching runs were made on glasses in iron foil envelopes. A quaternary liquidus field of olivine solid solutions extends into the system to about 35 mol percent Fs and about 41 mol percent En. The steep quaternary liquidus for silica includes all of the diagram above about 53.59 mol percent Fs. The ternary liquidus for pyroxenes is a shallow trough with lowest temperatures toward Hd.—E.H.R.

0059 **Roethlisberger, Hans; Bentley, Charles R.; Bennett, Hugh.** Movement studies by seismic soundings in the Greenland ice sheet: U.S. Army Materiel Command Cold Regions Research and Eng. Lab. Research Rept. 161, 25 p., illus., tables, 1965.

Seismic soundings at Site 2 (76°59′N, 56°05′W) on the Greenland ice sheet indicated that an area of considerable subsurface irregular topography existed at the base of the ice sheet, from which good reflections could be obtained and for which typical features could be mapped sufficiently accurately by seismic soundings so that they could be identified again in a later survey. Detailed seismic surveys were carried out in 1956 and 1959 in a marked area to determine movement at the surface for the 3-year period relative to the subsurface topography. In both studies the reflection times were plotted on a grid and contoured. The results indicate that little surface movement had taken place, but the reflection records were not sufficiently high in quality to give an accurate estimate of shift.—M.C.

0244 **Rohr, Gene M.; Rodenberg, Keith; Trigger, James.** Structural analysis of the Shell Canyon area, Bighorn Mountains, Wyoming: Iowa Acad. Sci. Proc. 1964, v. 71, p. 292–303, illus., 1965.

The area is divided by Shell Canyon into two structurally dissimilar regions corresponding to the northern and central structural provinces of the Bighorn Mountains. The northern part has steeper dips and fewer flexures, the uppermost being a chevron fold, and the only fault is the vertical Horse Creek Fault. South of the Canyon the front is lower, with more numerous and broader flexures, of which the upper is concentric. Planar fractures in the Paleozoic strata show definite preferred orientation. Each fracture pattern has one dominant direction, usually perpendicular to axial traces, which is interpreted as shear. The three thrust faults in Trapper Creek agree in strike and dip direction with a weak set of fractures. The three vertical faults in White Creek are aligned with the dominant set of fractures and are of similar origin.—M.C. 0354

Ross, Arnold. *See* Lewis, Jackson E. 0181

0040 **Rosztoczy, Ferenc E.** The growth of crocoite single crystals: Am. Mineralogist, v. 50, nos. 5–6, p. 755–757, illus., 1965. 0024

Thin needles 0.1 mm in diameter, 30–40 mm long, of $PbCrO_4$ were grown by chemical reactions between $PbCl_2$ and $Na_2Cr_2O_7$ in solution and by an acid hydrothermal reaction, using a temperature gradient and seed crystals. All crystals produced had monoclinic symmetry.—M.L.L.

0118 **Roth, Eldon S.** Temperature and water content as factors in desert weathering: Jour. Geology, v. 73, no. 3, p. 454–468, illus., tables, 1965.

Temperatures measured from the surface to depths of 25 inches in quartz monzonite on the Mojave Desert showed a maximum 24 hour change of 24°C, and a maximum temperature gradient of 15°C per ft. The water content of the rock at the end of the experiment increased inward from 0.05 percent near the surface to 0.15 percent at a depth of about one ft. Although the calculated expansion of constituent minerals is sizable for the temperature changes measured, temperature change alone is regarded as unimportant in rock weathering. It is suggested that water, present in even such a dry environment, is sufficient to serve as an important factor in weathering there.—D.R.M. 0277

0346 **Rowley, Peter D.** Precambrian geology in Humboldt Township, Marquette County, Michigan: Minnesota Acad. Sci. Jour., v. 32, no. 3, p. 197–200, illus., 1965.

In the Southern Complex of Michigan the average strike of foliation of the gneissic granite based upon orientation of feldspar phenocrysts is N. 60° W., of the major dike set is between N. 30° W. and N. 60° W., and of the fault zones is N. 52° W.; a two-mile long body of migmatite trends about N. 57° W. Gneissic granite was emplaced in early Precambrian, formed migmatites by incorporation of wall-rock material, and was faulted, intruded by dikes, and regionally metamorphosed to the almandine amphibolite facies. A second period of dike intrusion resulted in retrograde metamorphism by hydrothermal solutions in fissures.—G.D.C. 0070

0192 **Roy, M. M.** Studies on coal macerals—[Pt.] 3, Aerial oxidation of macerals: Econ. Geology, v. 60, no. 6, p. 1213–1217, tables, 1965.

Coal macerals were exposed to blown air at a temperature of 175°C for different periods of time up to 500 hours. In vitrinite and exinite, the drop in percentage of carbon and hydrogen increases up to 300 hours, but in fusinite the drop is negligible.—W.S.W.

0193 **Roy, Supriya.** Comparative study of the metamorphosed manganese protores of the world—the problem of the nomenclature of the gondites and kodurites: Econ. Geology, v. 60, no. 6, p. 1238–1260, tables, 1965. 0094

Metamorphosed manganiferous formations in Brazil, U.S.A., Ghana, French West Africa, Southwest Africa, Madagascar, Sweden, U.S.S.R., and Japan are each compared with the type gondites (metamorphosed non-calcareous manganiferous sediments containing manganese silicates and high-temperature lower oxides of

manganese) and kodurites (manganiferous skarn) described by Fermor from India.—W.S.W.

Rubin, Meyer. *See* McCulloch, David S. 0253

0354 **Rubinstein, C. B.; Barns, R. L.** Crystallographic data for rare-earth aluminum garnets, Pt. 2: Am. Mineralogist, v. 50, nos. 5–6, p. 782–785, tables, 1965.

Indexed X-ray powder data and index of refraction for gadolinium, ytterbium, and lutetium aluminum garnets are tabulated. Lattice parameters are 11.912 Å for Lu Al garnet, 11.929 for Yb Al garnet, 11.957 for Tm Al garnet, 11.981 for Er Al garnet, 12.011 for Ho Al garnet, 12.042 for Dy Al garnet, 12.074 for Tb Al garnet and 12.111 for Gd Al garnet.—M.L.L.

0024 **Rudman, A. J.; Summerson, C. H.; Hinze, W. J.** Geology of basement in midwestern United States: Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 894–904, illus., 1965.

Cross sections based upon seismic surveys and extrapolations from deep well data show that Paleozoic structures are underlain by basement ridges and scarps. Thickening and thinning of Lower Ordovician and Cambrian strata over basement scarps and ridges demonstrate basement influence on early Paleozoic sedimentation. A study of basement lithologies and isotopic age determinations help in the recognition of extensions of structural provinces of the Canadian shield into this region. Lineaг gravity and magnetic anomalies in Michigan, Indiana, Ohio, and Kentucky may be caused by Keweenawan-type basalts superposed on the predominantly granitic basement. Sparse data suggest a southwestern extension of the Grenville front through Michigan and Indiana.—E.E.G.

0277 **Ruhe, R. V.; Williams, J. M.; Hill, E. L.** Shorelines and submarine shelves, Oahu, Hawaii: Jour. Geology, v. 73, no. 3, p. 485–497, illus., 1965.

Morphometric analysis of recent detailed topographic maps and bathymetric charts in conjunction with soils studies confirms the existence of only 3 of the 14 previously proposed subaerial shorelines and only 2 of the 5 previously proposed submarine shelves. The 3 shorelines are the Hanauma, Waimanalo, and the Kaena at 12, 25, and 95 feet above present sea level, respectively. Mamala shelf is at a depth of 350 feet and the Lualualei is at a depth of 800 to 2,400 feet. The Lualualei shelf is regarded as a Miocene feature, possibly warped, and the other shelf and the shorelines are regarded as Quaternary, due mainly to eustatic changes of sea level.—R.E.W.

0070 **Rundle, Arthur S.** Glaciological investigations on Sukkertoppen Ice Cap, southwest Greenland, summer 1964: Ohio State Univ. Inst. Polar Studies Rept. 14, 11 p., illus., tables, 1965.

These studies were made during August 1964. Temperatures at depth indicate that much of the ice cap is temperate. Zonation according to Benson's facies concept is complex and there is probably overlapping of facies. Accumulation across the ice cap appears to be fairly uniform and any differences from one locality to another are small. Snow pit and core analyses show significant variation in accumulation from year to year, in some cases as much as 100 percent. Along the traverse route the mean net annual accumulation is 31 cm of water. Some processes involved in firn densification in the soaked facies of Benson's classification are discussed.—Author's abstract

Sandoval, P. *See* Murthy, V. Rama. 0086

0094 **Sanford, Allan R.** An instrumental study of New Mexico earthquakes: New Mexico Bur. Mines and Mineral Resources Circ. 78, 12 p., illus., tables, 1965.

Data from seismic stations in New Mexico and surrounding States were used to establish locations and magnitudes of earthquakes occurring in New Mexico from Jan. 1, 1962–June 30, 1964. The number and strength of shocks detected indicate a seismicity for New Mexico about 1/50 as great as that of southern California.

The two strongest shocks, greater than 3.5, were recorded from the northeast part of the State, where only one felt shock had been reported in 60 yr. Seven shocks greater than 2.75 were reported. Most shocks were in the southwest part, following a geographical distribution in general agreement with historical reports. Activity in the west-central part proved much lower than the known seismicity based on historical records.—M.C.

Santos, J. F. *See* VanDenburgh, A. S. 0140

Sato, Yasuo. *See* Landisman, Mark. 0080

0034 **Sawkins, Fredrick J.** Oceanic lead isotopes and ore genesis [discussion of paper by John S. Brown, 1965]: Econ. Geology, v. 60, no. 5, p. 1083–1084, 1965.

Lead-isotope data cited by Brown (Econ. Geology, v. 60, p. 47–68, 1965) in support of thesis that "principal ore fluid is essentially connate water concentrated by diagenetic processes" can also be interpreted to indicate a genetic relationship to volcanism.—W.S.W.

0044 **Schaller, Waldemar T.; Vlisidis, Angelina C.; Mrose, Mary E.** Macallisterite, $2MgO{\cdot}6B_2O_3{\cdot}15H_2O$, a new hydrous magnesium borate mineral from the Death Valley region, Inyo County, California: Am. Mineralogist, v. 50, nos. 5–6, p. 629–640, illus., tables, 1965.

Macallisterite occurs as small pellets of clusters of crystals intimately intermixed with ginorite and sassolite. The compound was first synthesized by Rammelsberg in 1840; the new mineral is named after James F. McAllister, geologist, U.S. Geological Survey, who first detected its presence in the Death Valley region. Macallisterite is trigonal and crystals are rhombohedral scalenohedral. Crystal structures are discussed in detail.—J.R.C.

0106 **Scheidegger, A. E.** Evaluation des méthodes de calcul d'un déplacement miscible instable dans un gisement de pétrole [with English and Spanish abstracts]: Inst. Francais Pétrole Rev., v. 20, no. 6, p. 879–884, illus., 1965.

The methods proposed in the literature for the description of unstable miscible displacement are evaluated. It is shown that a theoretical justification can be given for a heuristic procedure proposed by Koval which leads to the Buckley and Leverett equations. For this reason, it is suggested that Koval's method is the best available to date for the treatment of practical problems [in petroleum reservoir formations].—Author's abstract

0036 **Schenk, Erwin.** Pleistozäne Eiskeil-Polygonnetze im Vergleich mit heutzeitlichen Vorkommen in Alaska: Natur u. Mus., v. 95, no. 1, p. 8–16, illus., 1965.

Pleistocene ice-wedge polygon nets which have been found on the north coast of Point Barrow, Alaska, and in the Vogelsberg of Germany are compared with present-day periglacial features. Some, interbanded with iron-formation strata which folded, are illustrated from Point Barrow and from Vogelsberg mines. Solifluction in permafrost is thought to contribute to this structure.—G.D.C.

Schofield, D. A. *See* Fisher, W. L. 0366

0287 **Scholl, David W.** Recent sedimentary record in mangrove swamps and rise in sea level over the southwestern coast of Florida, Pt. 2: Marine Geology, v. 2, no. 4, p. 343–364, 1964.

Part 1 of this paper (1964) describes a sedimentary succession from the mangrove swamps of southwestern Florida attesting to a 10-ft eustatic rise in sea level during the last 4,000 yr. This paper considers the time of formation of the succession and the morphological development of submerged parts of the coastal swamps. Carbon-14 dates demonstrate that coastal mangrove swamps formed in the Whitewater Bay region about 3,000 yr ago, and to the north in the Huston Bay region about 3,500 yr ago. A tabulation is made of the 45 C-14 dates prepared

for this study; field locations of all piston cores and dated materials are shown on maps, and core sections are illustrated to show stratigraphy, C-14 dates, and type of material dated. The accuracy of the dates is discussed.—V.S.N.

0047 **Schwarcz, H. P.; Speelman, E. L.** Determination of sulfur and carbon coordination in scapolite by infra-red absorption spectrophotometry: Am. Mineralogist, v. 50, nos. 5-6, p. 656-666, illus., 1965.

An attempt has been made to identify the valence and coordination of sulfur and carbon in scapolite, by searching for infrared absorption peaks whose intensity varies with the sulfur and carbon content of the sample. Because of interference by Si-O vibrational spectra it is impossible to decide whether SO_4^{2-} or HSO_4^- ions are present. Sulfite ions may be present in high-sulfur scapolites. Carbon is present as the carbonate ion, probably strongly bound in a discrete structural site. A method of determining the CO_2 content of any scapolite has been developed. Recent analyses of scapolite suggest that carbon and sulfur may enter the scapolite structure loosely paired in some way.—Authors' abstract

0278 **Schwarcz, H. P.** The origin of diamonds in drift of the north central United States: Jour. Geology, v. 73, no. 4, p. 657-663, illus., 1965.

Diamonds found in Wisconsin drift in Ohio, Indiana, Michigan, and Wisconsin are proposed to have been carried south from an ancient meteorite crater at present outlined by the Nastapoka island arc in southeastern Hudson Bay. Following meteorite impact, brecciation extended to a depth of about 150 km, and fragments of this mantle-rock breccia, enclosing diamonds, are inferred to have been brought to the surface in a central uplift similar to those found in lunar craters. Following the crater's formation, sediments filled it and were lithified, but these rocks are thought to have slid by gravity from the central part of the crater as it rose isostatically, permitting the diamond-bearing rocks to be re-exposed.—Author's abstract

0129 **Schwartz, Maurice.** Laboratory study of sea-level rise as a cause of shore erosion: Jour. Geology, v. 73, no. 3, p. 528-533, illus., tables, 1965.

In contrast to classic concepts of the relationship of sea-level change to shore erosion, Per Bruun has proposed a new theory giving dimensional relationships to the process. To make a preliminary test of the validity of the theory, a small-scale model study was conducted, using constant beach and wave characteristics under variable conditions of water-level rise. Equilibrium was rapidly established with erosion and deposition taking place as predicted by Bruun.—Author's abstract

Scott, Alan J. *See* Siler, Walter L. 0055

Scott, Alan J. *See* Hayes, Miles O. 0223

0347 **Scott, Alan J.** Indian Point, Stop 6 *in* Depositional environments, south central Texas coast—Gulf Coast Assoc. Geol. Socs., Ann. Mtg., 1964, Field Trip Guidebook: Austin, Tex., Gulf Coast Assoc. Geol. Socs., p. 42-52, illus., 1964.

This stop illustrates the distribution of sediments in a modern tidal flat, the sedimentary structures, and distinctive facies to be found in selected cores, and the changing levels and shifting vegetation as the result of "Hurricane Carla". This is an example of the complexities of the "bay margin" facies.—G.D.C.

0133 **Selleck, D. J.; Campbell, W. A.** Exploration and development of the Carol ores, *in* Mining Symposium, 26th Ann., Duluth, 1965 (AIME, Minnesota Sec., 38th Ann. Mtg.): Minneapolis, Univ. Minnesota Center Continuation Study, p. 15-22, illus., 1965.

The existence of low-grade iron formation in the Carol Lake area of the Labrador Trough has been known since 1933, but its systematic exploration was not begun until 1949. This paper describes the local geology, the exploration approach used to assess the region, and the methods used to develop the first open pit mine, completed in 1962. The description of the rocks is limited to those of the Wabush

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Iron Formation of Proterozoic age, particularly the Upper Wabush which contains the Carol ores, chiefly magnetite and specularite. Ten major deposits of iron grading 38 percent iron have been outlined, with overall reserves in excess of three billion tons.—G.D.C.

Sestak, J. *See* Bergstein, A. 0048

0138 **Shallom, Lizzie Jacob.** Pleistocene molluscan fauna of the Lac Blanc deposit, Matapédia County, Quebec, Canada: Sterkiana, no. 19, p. 41–54, illus., table, 1965.

In this investigation of the paleoecology of the non-marine Mollusca of the Lac Blanc deposit, from data yielded by a systematically collected stratigraphic section, emphasis is placed on quantitative changes in species which are reflected in lithology and environment. The Lac Blanc deposit in Awantkish Township consists of marl and peat of lacustrine origin, resting on glacial boulders brought in by Laurentide ice. Of the 15 species of Mollusca recorded only a few are native to the environment, indicated to be fairly shallow water, of pH 7 to 8, and soft bottom conditions. The shells occur in marl composing the lower 60 inches of the section; changes in species, not connected with lithology, increase in depth of water.—G.D.C.

0279 **Sharma, Taleshwar; Mueller, Robert F.; Clayton, Robert N.** O^{18}/O^{16} ratios of minerals from the iron formations of Quebec: Jour. Geology, v. 73, no. 4, p. 664–667, tables, 1965.

The O-18/O-16 ratios of quartz, magnetite, amphiboles, and pyroxenes were found to be about 10 per mil higher in the Quebec iron formations than in corresponding minerals from Lake Superior iron formations of comparable metamorphic rank. The O-18 contents of amphiboles and pyroxenes are quite uniform, and the fractionation between coexisting amphiboles and pyroxenes is nearly zero. The uniformity of the unusual isotopic composition appears to be a relict of the premetamorphic sediments, rather than a result of the regional metamorphism.—Authors' abstract

0315 **Sharp, William W.** Happytown Field, St. Martin Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 13–13c, illus., 1964.

Shaver, R. H. *See* Thompson, M. L. 0184

0170 **Shearer, Robert E.; Everson, William A.** Study of bacteriophages in controlling acid mine waters [abs.]: Mining Eng., v. 17, no. 8, p. 49, 1965.

0248 **Sheller, James W.** Geologic setting, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. iii–viii, illus., 1964.

The productive sediments of on-shore southwestern Louisiana are marine clastics of Eocene to middle Miocene age, deposited in a series of overlapping and coalescing deltas and back-bays on the continental shelf. The average regional dip southward, about 150 feet per mile at depths of 10,000–12,000 feet, is interrupted by anticlinal structures. Some of these are due to up-welling salt, and others to rotation of downthrown fault blocks. They are seldom less than 7,000 feet below the surface, and are characteristically elongated east-west. Stratigraphic displacement, commonly under 1,000 feet, sometimes exceeds 3,000 feet. On both types, growth of the structure during or immediately after deposition of sand appears to be necessary for trapping oil or gas.—G.D.C.

0107 **Sherwood, C. B.; Grantham, R. G.** Water control vs. sea-water intrusion, Broward County, Florida: Florida Geol. Survey Leaflet 5, [13] p., illus., 1965.

This leaflet tells in general terms how sea-water intrusion in the aquifer in Broward County came about, what has been done to control the intrusion, and what must be done to conserve the fresh water and keep the ocean where it belongs. The principles described are valid for any coastal area having a similar hydrology.—G.D.C.

Short, Nicholas M. *See* Knox, Joseph B. 0299

0055 **Siler, Walter L.; Scott, Alan J.** Biotic assemblages, south Texas coast, *in* Depositional environments, south-central Texas coast—Gulf Coast Assoc. Geol. Socs., Ann. Mtg., 1964, Field Trip Guidebook: Austin, Tex., Gulf Coast Assoc. Geol. Socs., p. 137–157, illus., tables, 1964.

Characteristic biotic assemblages of marginal marine environments of the inner shelf, barrier, tidal delta–tidal channel, and lagoon–bay complexes of the south Texas coast are discussed briefly. The environmental ranges of plants (Table 1) and selected macro-invertebrates (Table 2) are tabulated.—Authors' abstract

0237 **Skinner, Hubert C.** Stratigraphic correlation in the Gulf Coast [abs.]: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 129, 1964.

0327 **Slingerland, Robert E.** North Ossun Field, Lafayette Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 25–25c, illus., 1964.

Smith, C. I. *See* Lozo, F. E. 0220

0119 **Smith, H. T. U.** Dune morphology and chronology in central and western Nebraska: Jour. Geology, v. 73, no. 4, p. 557–578, illus., 1965.

Stabilized dunes in the largest dune area of North America are of three types, each formed at a different time during the late Pleistocene. The oldest dunes are broad, massive forms that probably originated as compound transverse dunes during early Wisconsin time. Dunes of intermediate age, probably late Wisconsin, are narrow, more or less symmetrical, subparallel ridges of intermediate length that are interpreted as non-migratory upsiloidal forms transitional into longitudinal types. The youngest dune features, probably formed during the Hypsithermal interval, are relatively small and variable blowouts and upsiloidal dunes superimposed on the older dune topography. Prevailing wind directions were from the north and northwest.—V.E.S.

0185 **Smith, Jerry G.; Kapp, Donald O.** Pollen analysis of some Pleistocene sediments from Illinois: Illinois Acad. Sci. Trans., v. 57, no. 3, p. 158–162, illus., table, 1964.

The pollen content of sediments collected in a strip mine south of Canton, Illinois, tends to confirm the intra-Illinoian stratigraphic placement of the deposit. High percentages of spruce and pine pollen found in the samples and larch wood are typical of sediments dating from glacial ages. A warming trend may be revealed by presence of deciduous pollen near the middle of the sediments. It seems likely that the sediments are from a late Illinoian interstadial and may be contemporaneous with the Roby silt. The extensive Pennsylvanian deposits over which the glaciers advanced account for the presence of numerous Paleozoic spores.—Authors' abstract

Smith, R. I. *See* Chelini, J. M. 0265

0316 **Snyder, Robert D.** Horseshoe Bayou Field, St. Mary Parish, Louisiana, *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 14–14d, illus., 1964.

0095 **Sokal, Robert R.** Statistical methods in systematics: Cambridge Philos. Soc. Biol. Rev., v. 40, no. 3, p. 337–391, illus., 1965.

Taxonomists whose orientation is primarily biological state that in the study of systematics statistics should be used only as an auxiliary device to test hypotheses about biological processes. Sokal claims a more central place for statistics, since biological processes are largely concerned with populations. However, unimaginative application may lead to wrong conclusions. Specific cautions incorporated in the discussion of various methods are summarized, as: insufficient data; improper assumptions; and improper hypotheses. The correct choice of characters is of great importance. Covariation between characters, by means of

correlation and regression techniques, can be studied with more speed by the use of digital computers.—G.D.C.

Spackman, W. *See* Kremp, G. O. W. 0056

Speelman, E. L. *See* Schwarcz, H. P. 0047

0126 **Stanley, Daniel J.** An interpretation of turbidites whose sole markings show multiple directional trends [discussion of paper by K. W. Glennie, 1963]: Jour. Geology, v. 73, no. 4, p. 670–671, 1965.

Sole markings interpreted by Glennie (Jour. Geology, v. 71, p. 525–527, 1963) as resulting from the scouring action of several turbidity currents crossing the same point within a short time interval are reinterpreted according to the hypothesis of Prentice (Jour. Geology, v. 68, p. 217–225, 1960) as resulting from turbidity currents flowing transversely across a slope before being deflected along the maximum inclination of the sea floor.—B.F.L.

0343 **Steinbrugge, Karl V.; Cloud, William K.** Preliminary engineering report, *in* The Puget Sound, Washington, earthquake of April 29, 1965: Washington, D. C., U.S. Coast and Geod. Survey, p. 27–51, 1965.

Damage to engineering structures resulting from the April 29, 1965, earthquake, epicentered 13 mi southeast of downtown Seattle, Wash., is discussed and illustrated. Copies of records from strong motion seismographs at Olympia, Tacoma, and Seattle are shown; those from Olympia and Seattle are compared with records from the 1949 earthquake recorded by the same instruments. The 1949 shock was the stronger of the two at Olympia. The surface intensity for both shocks was more moderate over a wider area than comparable magnitude but shallower focus California earthquakes.—V.S.N.

Steinhart, J. S. *See* Hart, S. R. 0162

0229 **Steinhoff, R. O.** The West White Lake field, Vermilion Parish, Louisiana, and its relation to the alignments of oil and gas fields in South Louisiana: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 153–178, illus., 1964.

The West White Lake field is a faulted, northwest–southeast elongated anticline, one of many such Tertiary folds which buckled at frequent intervals normal to the regional arcuate strike of the beds of Southern Louisiana. A multitude of regional down-to-the-basin faults parallel the strike of the beds; where they cut the anticlines, producing structures such as West White Lake may result. Smaller compensating up-to-the-basin faults also cut the West White Lake fold only. Fault movement and anticlinal buckling were contemporaneous with sedimentation, the activity decreasing as the hinge line migrated seaward. Other structures, including salt domes, may occur at points of weakness created by intersections. The result is a grid pattern of producing structures in South Louisiana.—G.D.C.

Stewart, David P. *See* MacClintock, Paul. 0338

0155 **Stickney, Webster F.** Geology, Pt. 1 *in* A detailed economic investigation of geochemical and aeromagnetic anomalies, north central Maine: Maine Geol. Survey Spec. Econ. Studies Ser. 4, p. 3–29, i–iii, illus., geol. map, 1965.

The area, in parts of Piscataquis and Somerset Counties, is underlain by sediments and intrusives of Lower Paleozoic age, all intensively metamorphosed and with tight vertical folds. The northwest corner lies on the southeast limb of the Moose River synclinorium, a large northeast-trending series of folds in Devonian sedimentary rocks interbedded with volcanic flows and tuffs. Southeast of this are the oldest Devonian and Silurian units, slates, phyllites, and siltstones, underlain by Ordovician eugeosynclinal metasediments and volcanics, with the contact between the Ordovician and younger rocks, one of the major unconformity and thrust faulting. To the east and southeast, Siluro–Devonian calcareous argillites reappear overlain by a thick sequence of dark slates and sandstones of the Seboomook Formation. Devonian.—M.C.

0157 **Stoddart, D. R.** British Honduras cays and the low wooded island problem: Inst. British Geographers Trans., no. 36, p. 131–147, illus., 1965.

Reef patches with seaward shingle ramparts, leeward sand cay, and intervening shallow lagoon in the Australian Great Barrier Reef lagoon are absent from the linear outer and inner reefs of that area. Their pattern of distribution is suggested by J. A. Steers to be due to changing conditions of reef exposure, with signs of eustatic movement. Conversely, M. A. Spender held them to be the result of tilting of the reef area normal to the shore. Similar islands are described from the British Honduras barrier reef lagoon, where there is no evidence for Recent negative sea-level movement, and it is unlikely that similar tilting has taken place. A simple qualitative energy model is developed which accounts for these islands in both areas.—G.D.C.

0064 **Strahler, Arthur N.** Introduction to physical geography: New York, John Wiley and Sons, 455 p., illus., tables, 1965.

This textbook is a shorter, revised version of Strahler's well-known *Physical Geography*, and is designed for a one-semester course instead of a full year. First priority is given to the human environment—climates, landforms, surface waters, soils, and vegetation. Entire topics and chapters dealing with certain aspects of astronomy, geophysics, geodesy, and cartography, and exercises and the extensive topical bibliography are deleted.—G.D.C.

0225 **Stuckey, Charles W., Jr.** The stratigraphic relationship of the Hackberry, Abbeville and Harang faunal assemblages: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 209–216, illus., 1964.

Three embayments occurred in the Texas and Louisiana Gulf Coastal area since Vicksburg (Oligocene) time in which shale tongues were deposited. The tongues are unique in containing an outer-neritic fauna with no apparent littoral equivalent. Little evolutionary change is apparent in the fauna and the lithology of the beds is similar. The embayments occurred in middle Oligocene, lower and middle Miocene times. Maps showing lateral extent of each embayment are presented. Dip sections illustrate the proper stratigraphic relationship.—Author's abstract

0163 **Studier, M. H.; Hayatsu, Ryoichi; Anders, Edward.** Organic compounds in carbonaceous chondrites: Science, v. 149, no. 3691, p. 1455–1459, illus., tables, 1965.

The abundance ratios of various organic compounds in carbonaceous chondrites correspond closely to that which would exist if these compounds formed under conditions of thermodynamic equilibrium in solar nebula after most of the hydrogen had been lost.—F.W.C.

Subitzky, Seymour. *See* Cordova, R. M. 0273

0121 **Suggate, R. P.** The definition of "interglacial": Jour. Geology, v. 73, no. 4, p. 619–626, illus., 1965.

An interglacial is defined as a warm period between two glaciations during which the temperature rose to that of the present day. Temperature alone is used to define an interglacial. An interglacial is a climatic episode, not a stratigraphic unit. The most satisfactory subdivision of the Quaternary uses climatic changes, and the most critical points of such changes are their beginnings. Thus, the beginnings of stages are best determined by the beginnings of rapid changes that led to glacials or interglacials; although the glacial or interglacial events lasted different lengths of time in different places, the time from one to another major change may not have differed significantly in different places.—D.R.M.

Summerson, C. H. *See* Rudman, A. J. 0024

0062 **Takayanagi, Yokichi.** Upper Cretaceous planktonic Foraminifera from the Putah Creek subsurface section along the Yolo–Solano County line, California: Tohoku Univ. Sci. Repts., 2d ser., Geology, v. 36, no. 2, p. 161–237, illus., 1965.

On the basis of their stratigraphic distribution, six concurrent-range zones are proposed in this subsurface section in the southwestern part of the Sacramento Valley. From seven formations 36 planktonic species are discriminated, including one new to science, and described. The six zones are correlated with stages of the European standard. A marked change in the planktonic foraminiferal components before and after the upper *Globotruncana schneegansi* zone indicates a reduction of the marine area during the later phase and local prevalence of colder water since then.—G.D.C.

0254 **Tanner, William F.** Cause and development of an ice age: Jour. Geology, v. 73, no. 3, p. 413–430, 1965.

Late Cenozoic glaciation is attributed to the near polar position of North America, with the onset of Pleistocene glaciation caused by tectonism in the Bering Strait reducing the flow of warm water from the Pacific Ocean into the Arctic Ocean. Glacial oscillation is a meteorological phenomenon: ice sheet margins migrate southerly toward the sources of moisture, the starting areas are starved, and their southern margins build into rims and migrate into warm latitudes and dry altitudes, where they melt. Isostasy provides the time lag for long interglacial periods. This model operates only on continents as "wide" as North America or Europe, and it predicts a new cold epoch in 10^2–10^4 yr with lowered sea level, and Pleistocene glaciation lasting about 10^6 yr.—from Author's abstract

0196 **Taylor, Charles M.; Radtke, Arthur S.** Preparation and polishing of ores and mill products for microscopic examination and electron microprobe analysis: Econ. Geology, v. 60, no. 6, p. 1306–1319, illus., 1965.

The polishing procedure involves 5 steps: (1) grinding with abrasive papers; (2) impregnation with epoxy; (3) rough polishing with diamond abrasive on silk- or nylon-covered laps; (4) vibratory polishing with 0.3 micron alumina on parafilm-covered stage; and (5) final hand-polishing with 0.05–0.1 micron alumina.—W.S.W.

Taylor, Dwight W. *See* McCulloch, David S. 0253

Texas University. *See* Gulf Coast Assoc. Geol. Societies. 0005

Thomas, William A. *See* Mann, C. John. 0334

0184 **Thompson, M. L.; Shaver, R. H.** Early Pennsylvanian microfaunas of the Illinois basin: Illinois Acad. Sci. Trans., v. 57, no. 1, p. 3–23, illus., tables, 1964.

Fusulinids and ostracods are found in early Pennsylvanian strata in the eastern part of the basin in Illinois, Indiana, and Kentucky. Numerous ostracod species occur in two easily recognized biostratigraphic zones in these rocks, the lower being the *Amphissites rothi* zone in marine units underlying Buffaloville Coal and Perth Limestone Member of the Brazil Formation or their equivalents, and the upper the *Amphissites centronotus* zone in limestones or shales above or associated with the same formations, unnamed because of its indefinite upper boundary. Various fusulinid species occur in the same strata and one new species, *Profusulinella burrensis*, is found in unnamed limestone in Fountain, Parke, and Warren Counties, Indiana.—M.C.

0227 **Thorsen, Carl E.** Miocene lithofacies in southeast Louisiana: Gulf Coast Assoc. Geol. Socs. Trans., v. 14, p. 193–200, illus., table, 1964.

The gross lithofacies of the Miocene are defined in terms of sand percent. On the basis of its vertical distribution, southeastern Louisiana is divided into four lithofacies provinces, interpreted in terms of their structural history. Province 1, characterized by a simple regressive facies, includes most of the lower Miocene. The lithofacies of Province 2, including the Harang Embayment, reflect a regressive-transgressive cycle related to growth fault movements. Province 3, coinciding with the Terrebonne Trough, is characterized by a massive sand facies which reflects younger growth faults. Province 4, including the lower Mississippi delta and adjacent offshore area, was structurally the most unstable, and its stratigraphy is the most complex.—G.D.C.

0148 **Tickell, F. G.** Developments in sedimentology—[V.] 4, The techniques of sedimentary mineralogy: Amsterdam, Elsevier Publishing Co., 220 p., illus., tables, 1965.

Tickell considers this volume as a handbook dealing with procedures for describing or evaluating various types of sedimentary material and explaining the techniques used in optical mineralogy in sufficient detail so that even beginners can apply them. Chapters discuss size analysis, bulk properties, specimen preparation, mineral identification, and descriptions of practically all minerals reported as occurring in sedimentary rocks with a special table listing by name the detrital minerals characteristic of six rock types: veins, acid igneous, basic igneous, pegmatite, metamorphic, and sediments. Four appendixes cover tables for microscopic identification of non-opaque detrital minerals found in sedimentary rocks; a set of orientation-cleavage crystal drawings of 100 minerals; and records of optical properties of positive and negative rock minerals.—M.C.

0032 **Trendall, A. F.** Origin of Precambrian iron formations [discussion of paper by H. Lepp and S. S. Goldich, 1964]: Econ. Geology, v. 60, no. 5, p. 1065–1070, 1965.

Paper of Lepp and Goldich (Econ. Geology, v. 59, p. 1025–1060, 1964) is criticized for wrongly using chemical data (e.g. statistically inadequate demonstration of inverse correlation of silica and carbon dioxide, and failure to consider alternative explanations if it does exist), and for confining their attention to limited characteristics of iron formations when other characteristics of iron formations and their total environment conflict with the proposed model. The absence of complementary alumina-rich rocks is posed as a particularly critical problem.—W.S.W.

Trigger, James. *See* Rohr, Gene M. 0244

Troxel, Bennie W. *See* Campbell, Ian. 0200

Tsong, C. F. *See* Berger, J. 0023

0009 **Turner, R. C.** A study of the lime potential —[Pt.] 5, Significance of the lime potential in aqueous acid clay systems: Soil Sci., v. 100, no. 1, p. 14–19, illus., 1965.

The experimental results for exchange between Al or Fe and Ca in Wyoming bentonite were found to apply as well to kaolin, illite, and a micaceous clay subsoil. The ion product $(Al)(OH)^3$ varied more than thousandfold, but its magnitude could not be connected with the kind of clay present. The lime potential is a function of the ion product $(Al)(OH)^3$ and the degree of Ca saturation, while pH is a function of these two variables plus the activity of Ca in solution.—J.W.H.

Tuttle, Sherwood D. *See* Milling, Marcus E. 0245

0156 **vanBemmelen, R. W.** The evolution of the Atlantic mega-undation (causing the American continental drift) [with French abstract]: Tectonophysics, v. 1, no. 5, p. 385–430, illus., tables, 1965.

Mega-undations, major upwarps and downwarps at the Earth's surface, arise from deep-seated mass-circuits or possibly from the Earth's expansion. Potential amplitudes may be 100 km but rarely exceed a few dozen meters because of compensation by sidewise spreading of the Earth's upper layers under gravity and isostatic adjustment. When mega-undations occur in primordial continents such as Gondwana and Laurasia, new oceanic basins open up at their tops with mid-oceanic ridges marking the crest and relatively deep parts of the outer mantle rising to the sea floor. Overlying structural levels drift sidewards under gravity towards the downwarps. Characteristic geotectonic features occur at all four sides of the drifting continent. Geotectonic analyses of the Atlantic mega-undation and North America drift support this theory.—M.C.

0123 **Vance, J. A.** Zoning in igneous plagioclase—Patchy zoning: Jour. Geology, v. 73, no. 4, p. 636–651, illus., 1965.

The patchy or mottled zoning in plagioclase commonly seen between crossed nicols is studied in detail in examples of plutonic, hypabyssal, and extrusive rocks of the northern Cascade Mountains of Washington. It is concluded that an important mechanism involves pressure release during rise of a water-deficient magma and, conversely, that the presence of patchy zoning (or oscillatory zoning) may indicate that the magma was undersaturated in volatiles during its early crystallization history.—R.E.W.

0140 **VanDenburgh, A. S.; Santos, J. F.** Ground water in Washington—Its chemical and physical quality: Washington Div. Water Resources Water Supply Bull. 24, 93 p., illus., tables, 1965.

Most ground water in the State has a chemical quality satisfactory for municipal, industrial, and agricultural use, usually much better than needed to meet minimum requirements. West of the Cascade Divide, most water comes from glacial and stream-derived sediments and with only 75–150 ppm dissolved-solids content. A higher content is found in water from a few wells tapping buried marine sedimentary deposits, where contamination from sea water from Puget Sound or the Pacific Ocean has occurred and will continue to develop with increased withdrawal of ground water from shallow aquifers. East of the Cascade Divide, ground water is similar in nature and quality and comes from sediments or from shallow to very deep aquifers in the layered basalt flows of the Columbia Plateau, but more wells, with water of poorer quality, occur here than in the west. The average temperature of the ground water is 65°F.—M.C.

0136 **VanderPlas, L.** In defence of point counting analysis, a reply [to discussion by G. M. Friedman, 1965]: Sedimentology, v. 4, no. 3, p. 249–251, 1965.

In his discussion of a paper by Van der Plas (ibid., v. 1, p. 145–157, 1962), Friedman (ibid., v. 4, no. 3, p. 247–249, 1965) criticized what apparently was meant to be a preliminary note on the granulometric analysis of sedimentary rocks, in which Van der Plas proposed merely to survey the properties of the various experimental methods in size analysis and to advocate the use of a special counting technique, which, however, was less apt to produce numerical data biased by a combination of both the properties of the sampling technique and those of the material under study. Van der Plas feels, therefore, that there is a difference of kind and not of degree between his approach and Friedman's and still maintains that point counting techniques generally lead to doubtful results in size analysis.—M.C.

VanSchalkwyk, A. *See* Goodman, R. E. 0115

VanSchmus, W. R. *See* Dodd, R. T., Jr. 0266

VanSiclen, DeWitt C. *See* Myers, Robert L. 0217

VanSiclen, DeWitt C. *See* Moredock, Duane E. 0218

0147 **Varley, E. R.** Sillimanite—Andalusite, kyanite, sillimanite: London, England, Overseas Geol. Surveys, Mineral Resources Div., 165 p., tables, 1965.

An introduction reviews the characteristics of the sillimanite group of naturally-occurring anhydrous aluminum silicates, their origin and mode of occurrence, grade and reserves, mining, calcination, uses, trade and marketing requirements, and possible substitutes. Brief descriptions are given of occurrences in Canada and the United States as well as other Commonwealth and foreign countries. An excellent list of technical references is included with twelve pages devoted to general topics discussed above and an additional seventeen pages devoted to area studies.—M.C.

Vitz, Howard E. *See* Jerome, S. E. 0057

Vlisidis, Angelina C. *See* Schaller, Waldemar T. 0044

0351 **Vredenburgh, L. D.; Lemish, John.** Evaluation of autoclave induced expansion of some Iowa carbonate rocks: Iowa Acad. Sci. Proc. 1964, v. 71, p. 335–341, illus., tables, 1965.

An autoclave environment of 110°C and a steam pressure of 25 psi was used to develop a rapid method of determining the expansive characteristics of some carbonate rocks. . . . Application of the autoclave method indicates that the rate of expansion is greatly increased but that the actual mechanism of expansion is not changed. Only those samples placed in an alkaline solution in the autoclave expanded. Control samples in distilled water showed negligible expansion. The expansion data obtained by the autoclave method is correlative with that obtained by standard procedures, but the test time required is considerably less. Therefore, this rapid autoclave method is suggested as a valid and applicable test in the study of carbonate aggregates.—Authors' abstract

Ward, Frederick N. *See* Brobst, Donald A. 0030

Warkentin, B. P. *See* DeJong, E. 0007

0269 **Warren, Harry V.; Delavault, Robert E.** Medical geology: Geotimes, v. 10, no. 2, p. 14–15, 1965.

Trace-element studies show that where our food is grown will affect our health. These studies raise many questions for doctors and earth scientists, some of which are pointed out briefly in this article. There are areas in the world, for instance, where foresters would not dream of planting new trees before consulting with their geological confreres. The elements known to be essential to plant and animal health may be nearer 40 than 30; they should be present not only in appropriate concentrations, but also with harmonious relationships between concentrations of the different elements. Biogeochemistry may involve many interdisciplinary subjects.—G.D.C.

Weiblen, Paul W. *See* Cadwell, Donald E. 0197

Welday, E. E. *See* Baird, A. K. 0359

0010 **Wells, B. R.; Graham, E. R.** Direct radioactive assay of cation retention by mineral and organic colloids: Soil Sci., v. 100, no. 1, p. 10–13, 1965.

The results indicate that the attraction by kaolin for Na and Cs is lower than that observed for illite, montmorillonite, Putman, fibrous peat, or leaf compost. The 2-illite clay reveals no differences in retention of Na and Cs with change in pH. The differences observed with Sr and Zn are slight. Zn is adsorbed by all colloidal systems even in the presence of high hydrogen saturation. To obtain reproducible results for cation-exchange capacity, the control of the suspension pH and use of a strontium salt containing Sr 85 is suggested.—J.W.H.

West, G. F. *See* Grant, F. S. 0082

0039 **Whetten, John T.** Wairakite from low-grade metamorphic rocks on St. Croix, U.S. Virgin Islands: Am. Mineralogist, v. 50, nos. 5–6, p. 752–755, 1965.

Wairakite was found in the Judith Fancy Formation in a metamorphased limestone containing 30 percent wairakite, 50 percent calcite, 10 percent clinozoisite and 3 percent prehnite. A temperature of formation above that of most common zeolites, which are not extensively developed on St. Croix, is inferred.—E.H.R.

0302 **White, Donald E.** Deep geothermal brine near Salton Sea, California [abs.]: Bull. Volcanol., v. 27, p. 369–370, 1964.

0187 **White, W. Arthur.** Origin of fissure fillings in a Pennsylvanian shale in Vermilion County, Illinois: Illinois Acad. Sci. Trans., v. 57, no. 4, p. 208–215, illus., tables, 1964.

The top 15 feet of the marine shale above the Summum (No. 4) Coal of Illinois contains vertical fissures that could not have been formed by regional jointing. Some of the fissures are filled with siderite, dolomite, and calcite in various proportions. The fissures were developed by synaeresis, and the fillings contain two additional generations of synaeresis cracks.—Author's abstract

0300 **Williams, Howel; McBirney, Alexander R.** Petrologic and structural contrast of the Quaternary volcanoes of Guatemala [abs.]: Bull. Volcanol., v. 27, p. 61, 1964.

Williams, Howel. *See* McBirney, Alexander R. 0301

Williams, J. M. *See* Ruhe, R. V. 0277

Willman, H. B. *See* Glass, H. D. 0283

Wilson, A. S. *See* Goebel, J. B. 0084

0209 **Wilson, Charles W., Jr.; Kirby, James P.; Miller, Robert A.** Geologic map of the Lynnville quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 58-NE, scale, 1:24,000, separate text, 1964.

The text to accompany this map, "Mineral resources summary of the Lynnville quadrangle, Tennessee," by C. E. L. McCary is cited separately.—M.C.M.

0068 **Wilson, Eldred D.** Guidebook 1—Highways of Arizona, U.S. Highway 666: Arizona Bur. Mines Bull. 174, 68 p., illus., tables, 1965.

This guidebook is essentially an illustrated road log of the scenery, vegetation, animal life, geology, and physiography to be found along the highway and is designed primarily for the general public rather than the geologist or engineer. Historical notes are included. A short glossary defines the various geologic terms used and a reference list of 20 articles is given.—M.C.

Wilson, Eldred D. *See* Moore, Richard T. 0101

0019 **Wilson, L. R.** *Rhizophagites*, a fossil fungus from the Pleistocene of Oklahoma: Oklahoma Geology Notes, v. 25, no. 9, p. 257–259, illus., 1965.

Rhizophagites Rosendahl, 1943, is a mycorrhizal type of fungus that is widely distributed through Pleistocene deposits in North America. Rosendahl's description, not easily available to palynologists, is given. His statement that the form probably became extinct at the end of the Pleistocene must be questioned, because essentially identical fragments have been found in topsoil samples and in Recent stream-terrace deposits. The living form was described by Butler (1939) as *Rhizophagus*; it may be desirable to abandon the fossil name. *Rhizophagites* occurs abundantly at the base of a cliff along Tesesquite Creek in Cimarron County, Okla., generally associated with moss and pollen of pine in dark blue-black clays.—G.D.C.

0022 **Wilson, L. R.** Charles David White [1862–1935]: Oklahoma Geology Notes, v. 25, no. 9, p. 246, portrait, 1965.

0153 **Wing, Lawrence A.** Geochemistry, Pt. 3 *in* A detailed economic investigation of geochemical and aeromagnetic anomalies, north central Maine: Maine Geol. Survey Spec. Econ. Studies Ser. 4, p. 75–81, i–iii, illus., 1965.

A reconnaissance geochemical survey was made in parts of Piscataquis and Somerset Counties on stream sediments collected from active channels and flood plains to test them for heavy metals and copper. Studies, made at 720 sampling stations representing about 1,400 samples and 2,300 measurements for heavy metals and copper, gave a median value of 4 ppm for heavy metals and 0.6 ppm for copper. The results indicate that at least 3 percent of the original stations would warrant further work.—M.C.

Winters, H. A. *See* Lukert, M. T. 0186

0342 **Wong, Her-Yue.** Clay mineralogy of lower Paleozoic rocks in Beavers Bend State Park, Ouachita Mountains, Oklahoma: Geol. Soc. China Proc. 1964, no. 8, p. 70–84, illus., tables, 1965.

The shale portions of the exposed strata in the "core area" of the Ouachita Mountains exhibit petrofabric and clay mineral evidence of low-grade metamorphism. The Mazarn Shale (Ordovician) is a phyllite and the shale parts of seven younger formations are slate. Of the clay minerals present—illite, chlorite, kaolinite and vermiculite—the most abundant is illite which occurs in both dioctahedral and trioctahedral forms. The trioctahedral illite seems to be associated with rocks of higher metamorphic rank; the chlorite minerals seem to be closely related to those rocks which exhibit higher degrees of deformation.—G.D.C.

Worl, Ronald G. *See* Hodge, Dennis S. 0169

0364 **Wright, C. M.** Syngenetic pyrite associated with a Precambrian iron ore deposit: Econ. Geology, v. 60, no. 5, p. 998–1019, illus., tables, 1965.

Pyrite makes up about 50 percent of the rock in lenticular bodies parallel to bedding at the top of or above the main Steep Rock, Ontario, iron-ore zone. Ninety percent of the pyrite is colloform and clearly older than the iron oxides. It does not replace the host rocks, and is believed to be syngenetic rather than hydrothermal in origin. This conclusion is supported by the low trace-element content of the pyrite, particularly its low Co–Ni ratio, high As, low Se, and lack of metals characterizing quartz veins related to nearby granite.—W.S.W.

Wright, Jack S. *See* Jerome, S. E. 0057

Wuttke, Krystyna. *See* Cailleux, André. 0141

0313 **Young, Burton L.** Garden City field, St. Mary Parish, Louisiana *in* Typical oil and gas fields of southwestern Louisiana: Lafayette, La., Lafayette Geol. Soc., p. 11–11e, illus., 1964.

0154 **Young, Robert S.** Geophysics, Pt. 2 *in* A detailed economic investigation of geochemical and aeromagnetic anomalies, north central Maine: Maine Geol. Survey Spec. Econ. Studies Ser. 4, p. 30–74, i–iii, illus., tables, 1965.

Eighteen individual prospects, all aeromagnetic or geochemical anomaly areas, in Piscataquis and Somerset Counties were examined in more or less detail during the 1963–64 field seasons using magnetic, self-potential, and electromagnetic methods. Twelve prospects were geochemical anomaly areas where geochemical sampling had been done on stream sediments, and the other six were in the areas of the Katahdin Iron Works, the Moxie–Moosehead gabbro, the Crawford Pond magnetic anomaly, and a sulfide occurrence in the Chase Stream valley. Eight areas were recommended for immediate further evaluation.—M.C.

Zandle, G. L. *See* Boynton, G. R. 0167

Zandle, G. L. *See* Boynton, G. R. 0175

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